Sign Language Semantics Day 4: Iconicity and linguistic typology

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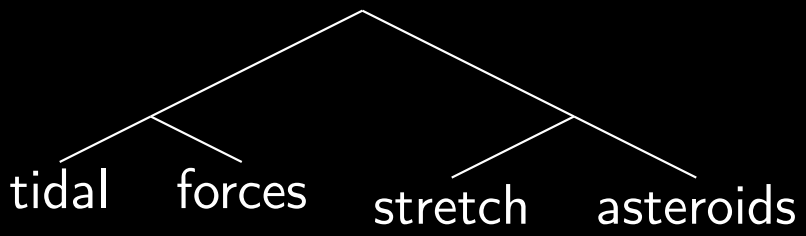
Two kinds of meaning



grammar

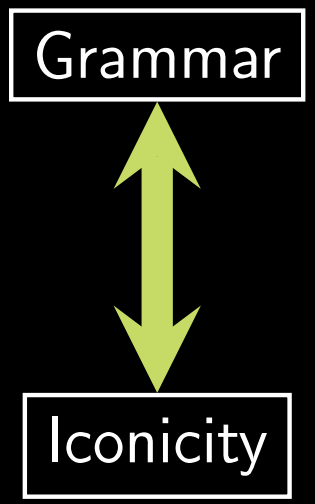
combinatorial & descriptive

iconicity

holistic & depictive

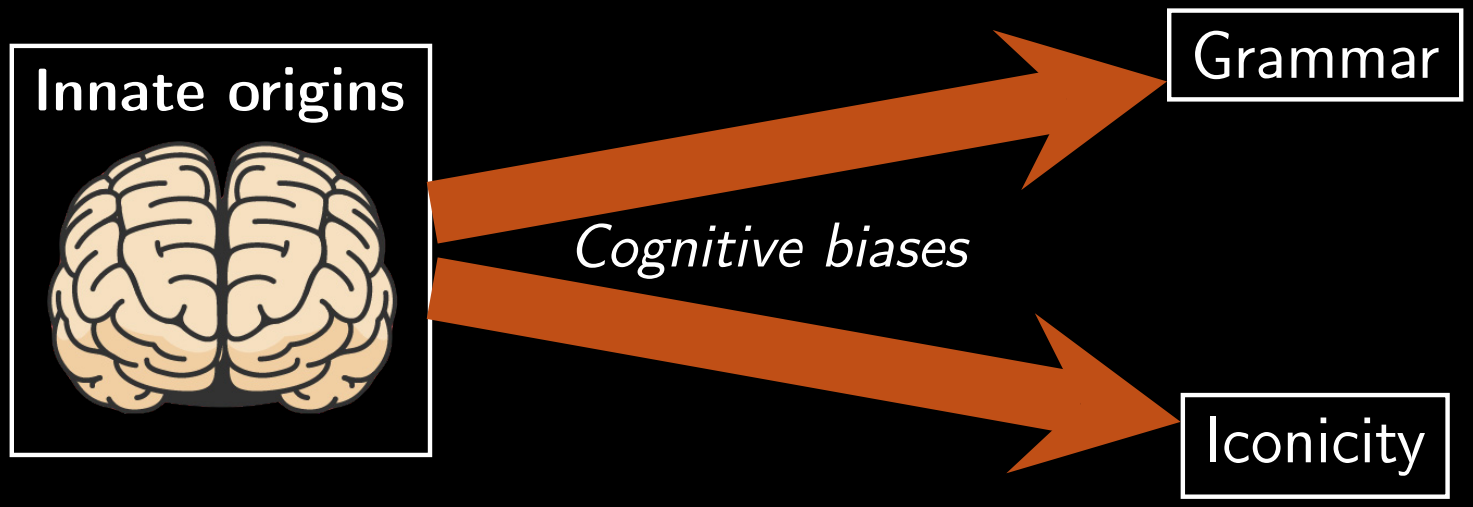
Two kinds of meaning

1. To what extent do these two systems interact?



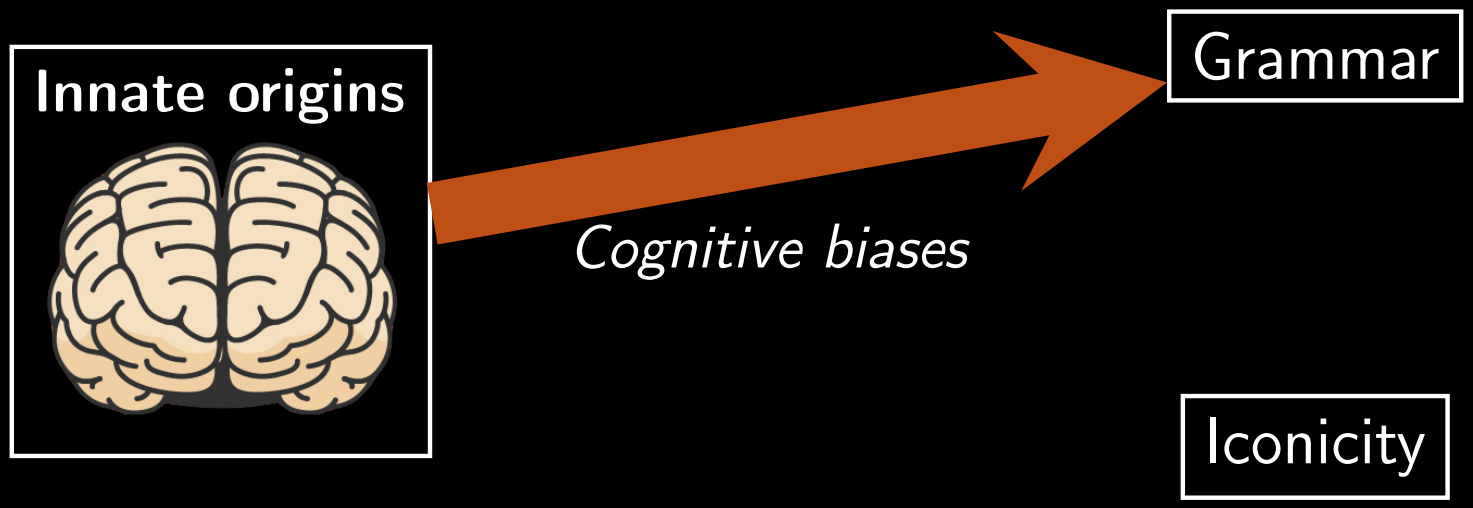
Two kinds of meaning

1. To what extent do these two systems interact?
2. What are the cognitive roots of each system?



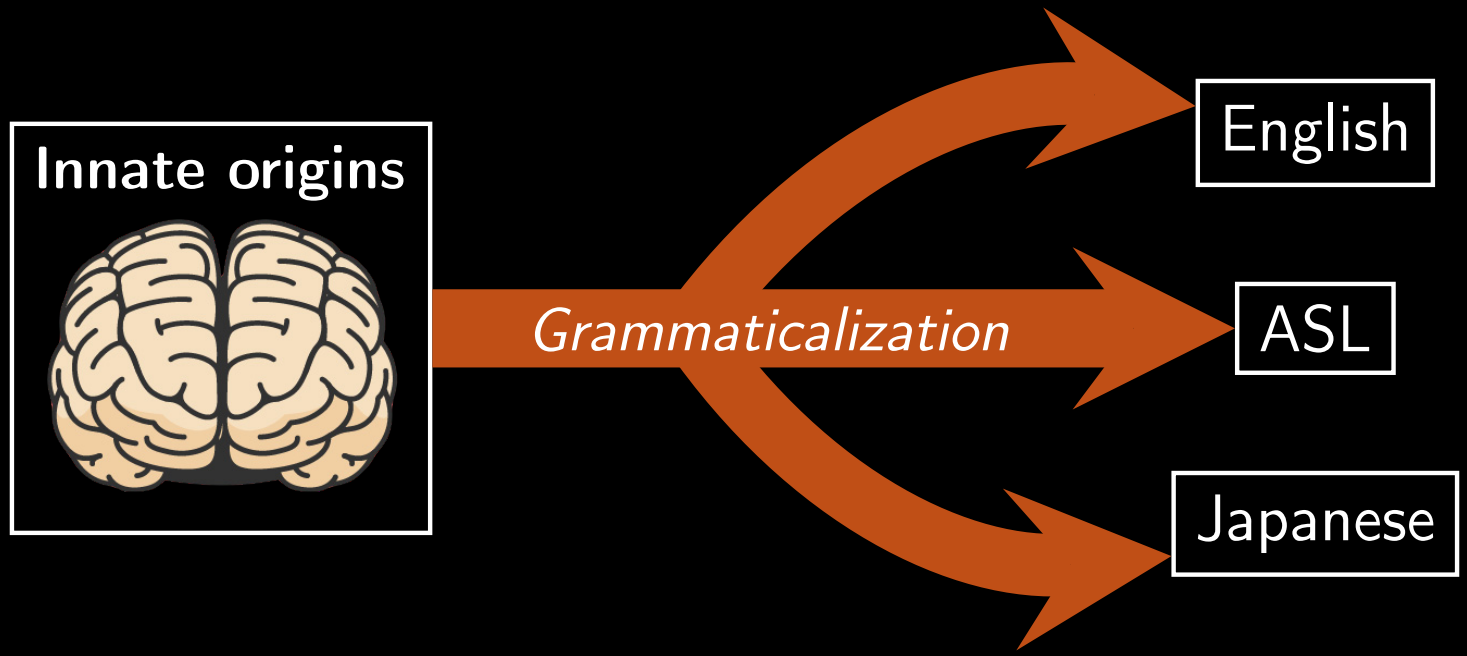
Two kinds of meaning

1. To what extent do these two systems interact?
2. What are the cognitive roots of each system?
   - A classic way to study the origins of grammar: **typology**.



Typology

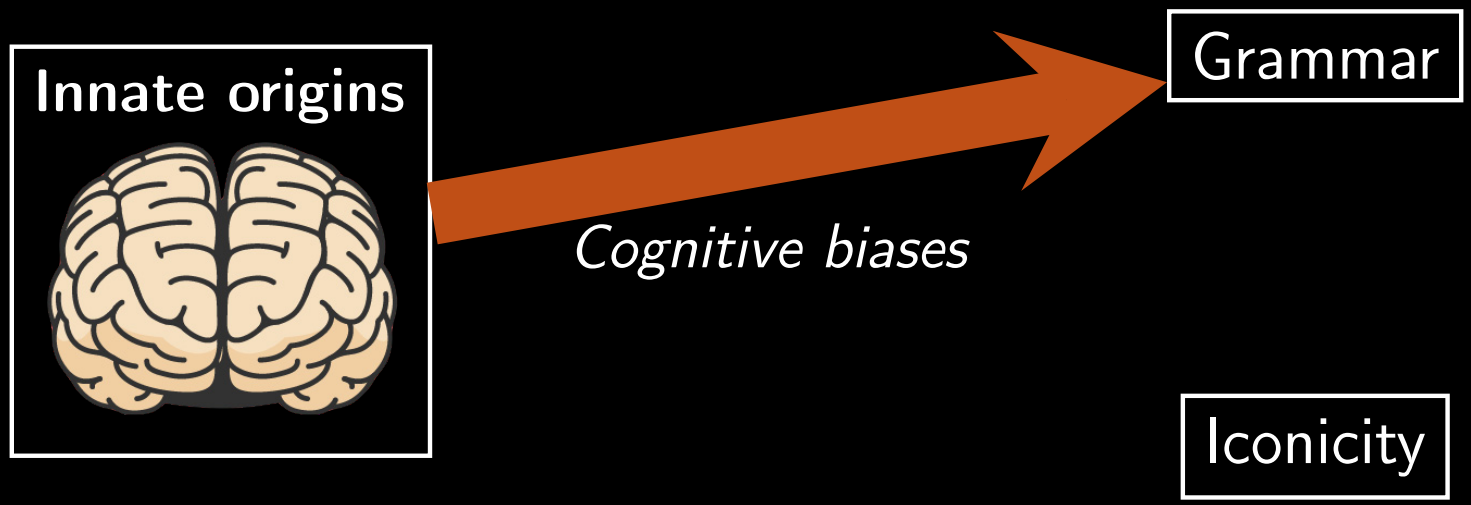
- What linguistic patterns are possible; what linguistic patterns are frequent; and why?



Cognitive biases

Hypothesis:

The cognitive biases that shape semantic typology also influence iconic mappings.



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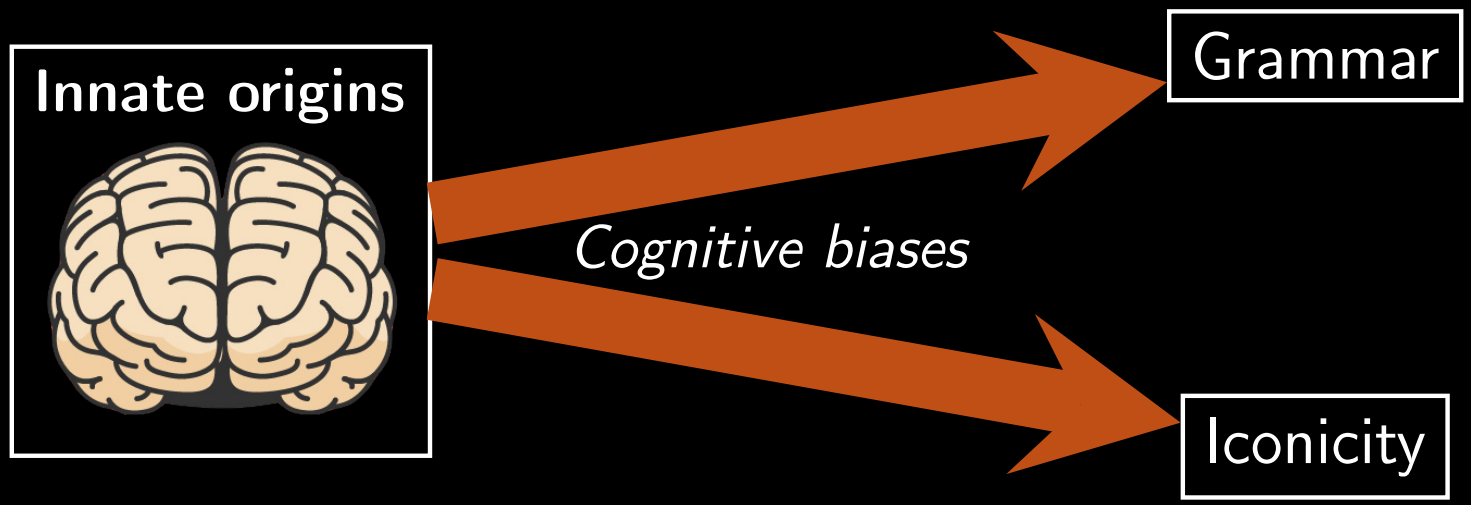

Cognitive biases

Consequence

- Iconicity can provide new evidence for semantic representations and the cognitive concepts on which they are founded.

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- Iconicity of **logical, abstract meaning**, not just concrete, sensory-based properties.

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Consequence

- Iconicity can provide new evidence for semantic representations and the cognitive concepts on which they are founded.
- Iconicity of **logical, abstract meaning**, not just concrete, sensory-based properties.
- Sign languages are an ideal testing ground.

Method

Two case studies, with the same basic method:

1. Logical concepts implicated in semantic typology
2. Iconic tendencies in sign language
3. Explanation via iconic biases
4. Experiments to test these biases for non-signers


Quantification

Quantification

Quantification in English

(1) Somebody read a book. $\exists x\,[P\,x]$

(2) Everybody read a book. $\forall x\,[P\,x]$

(3) Nobody read a book. $\neg\exists x\,[P\,x]$

Quantification

Quantification in English

(1) Somebody read a book. $\exists x\,[P\,x]$

(2) Everybody read a book. $\forall x\,[P\,x]$

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Quantification

Negative concord ($\neg$)

(4) Marija ne videla nichego. (Russian)

(5) Maria non ha visto niente. (Italian)
'Mary didn't see anything.'

Quantification

Negative concord ($\neg$)

(4) Marija ne videla nichego. (Russian)

(5) Maria non ha visto niente. (Italian)
'Mary didn't see anything.'

(6) Mary didn't see nothing. (Standard English)
'Mary *did* see something.'

Quantification

Distributive concord ($\forall$)

(7) Minden gyerek hozott egy-egy könyvet.
Every(DIST) child brought one-DIST book.
'Every child brought one book.' (Hungarian)

(8) Chikijujunal ri tijoxela' xkiq'etej ju-jun tz'i'.
each(DIST) the students hugged one-DIST dog
'Each of the students hugged one dog.' (Kaqchikel)

Quantification

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'Each of the students hugged one dog.' (Kaqchikel)

(9) # Every child read one book each. (English)

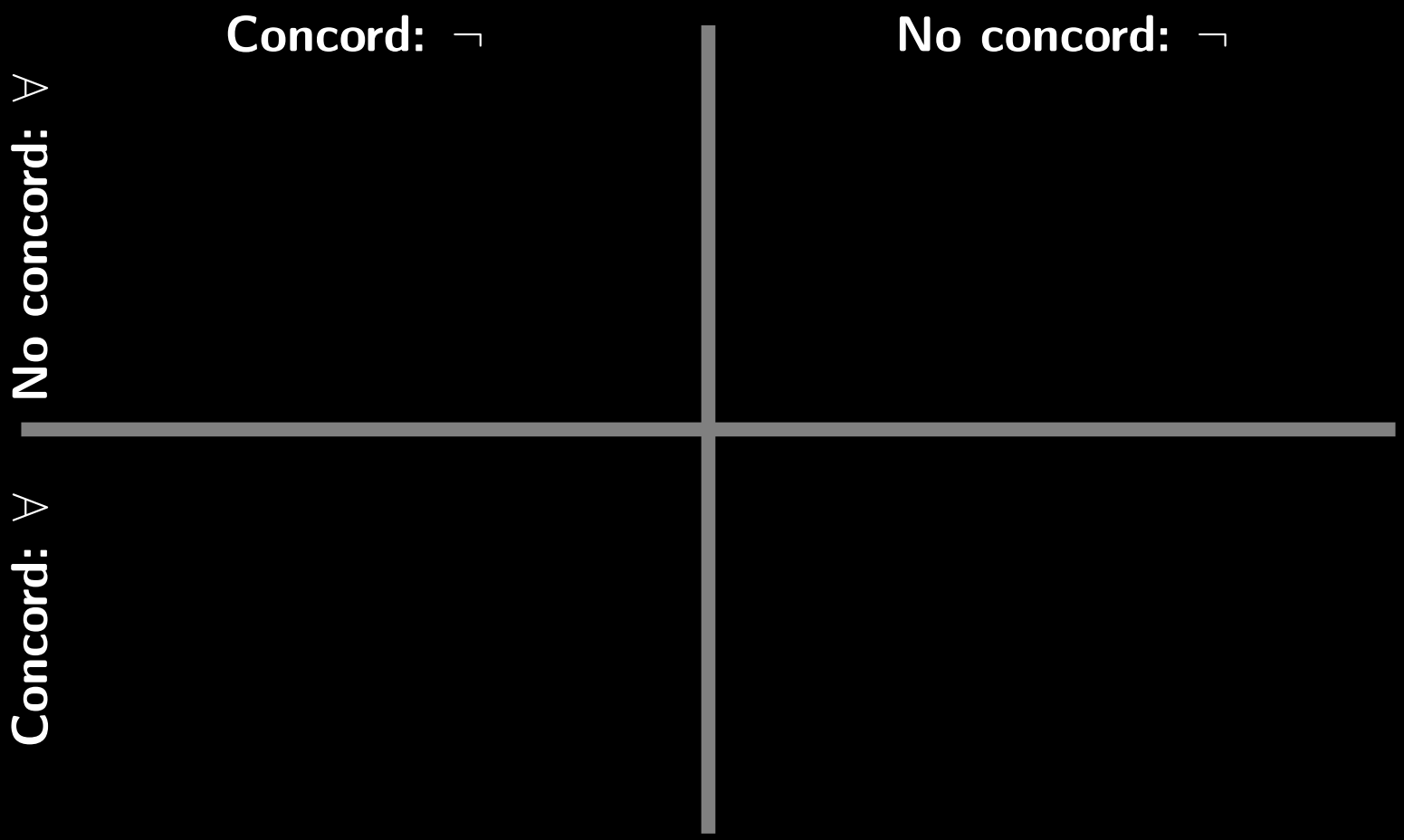
Quantification

Do languages allow/require redundant marking...

...of negation ($\neg$)?

...of distributivity ($\forall$)?

Quantification



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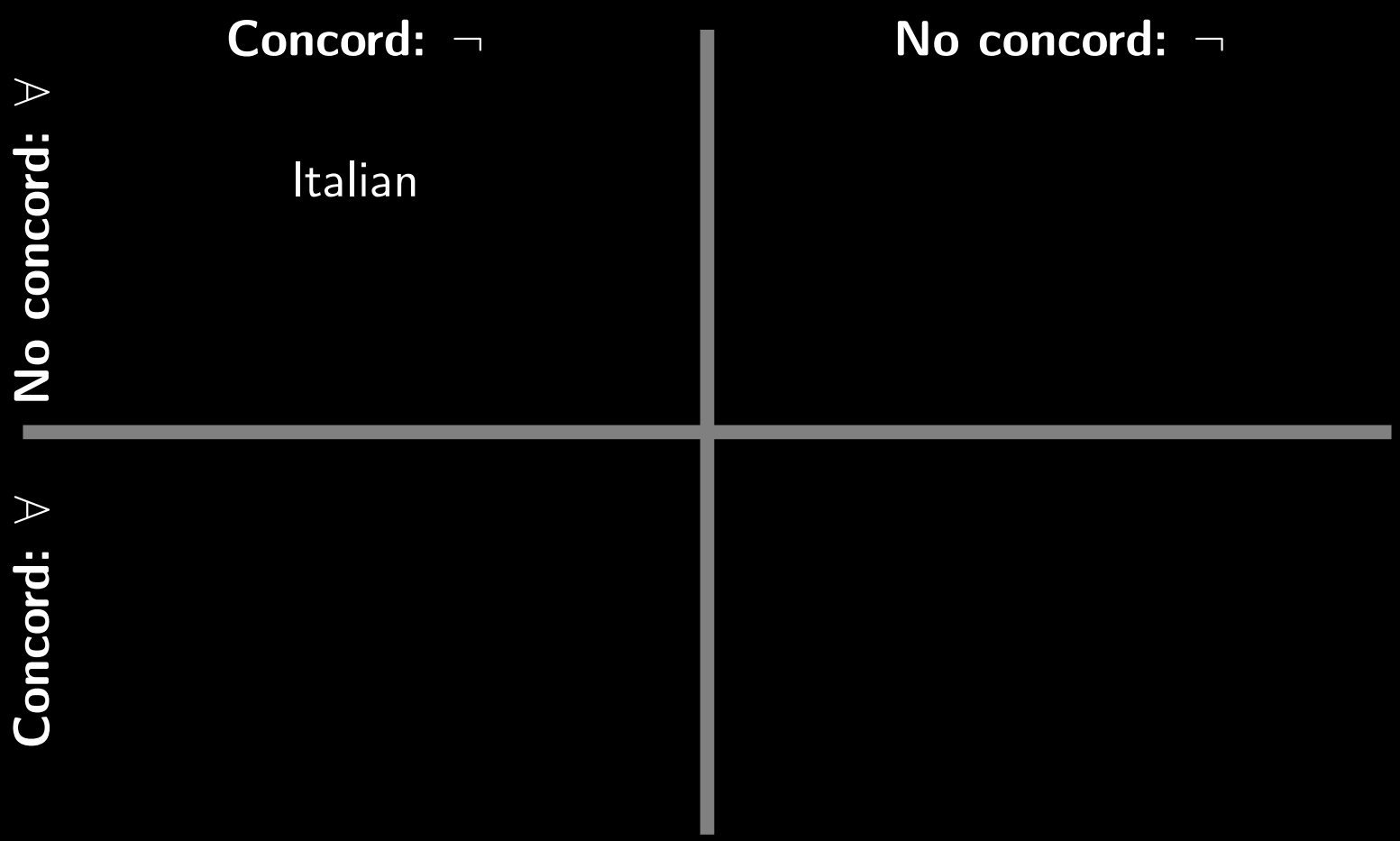

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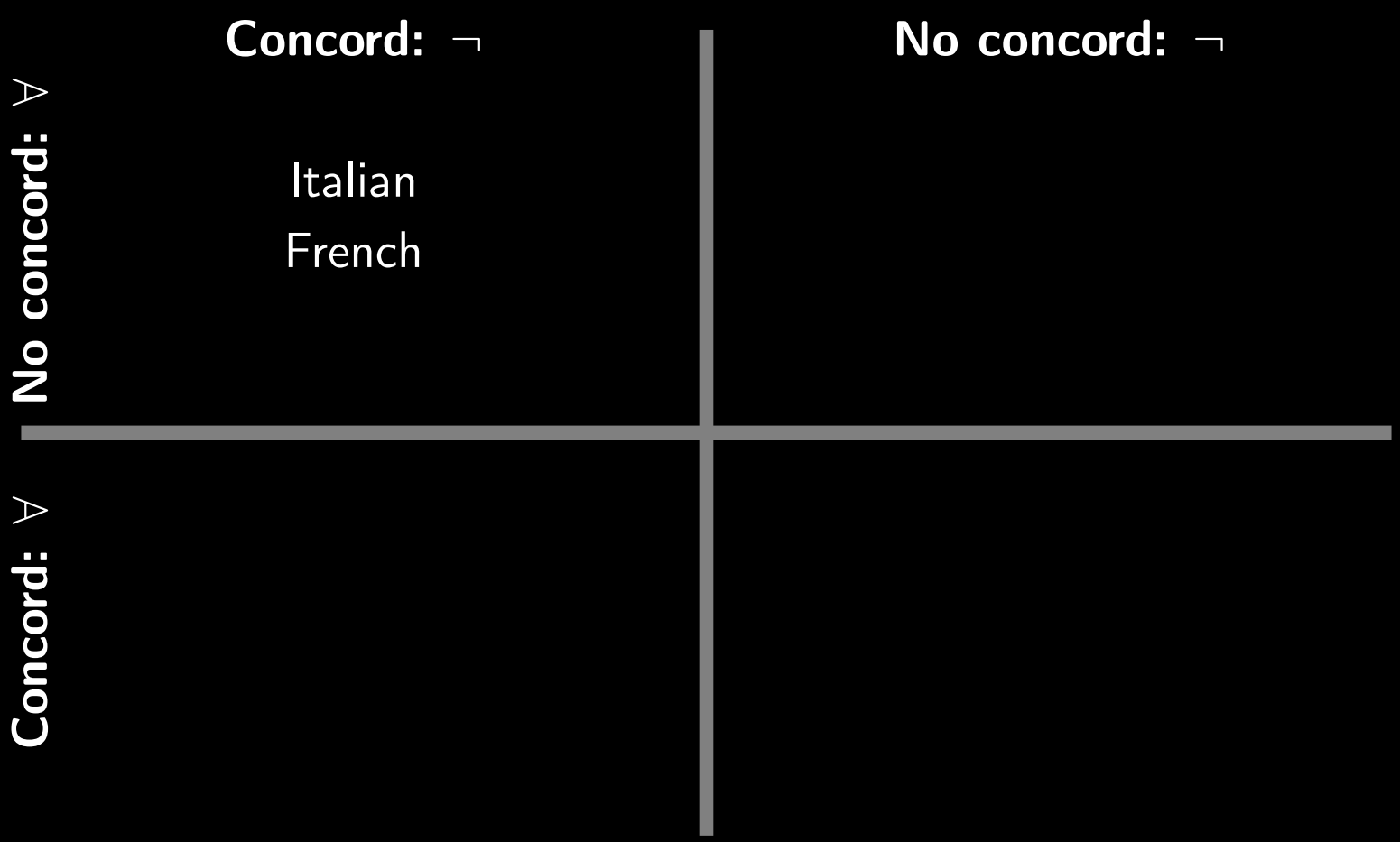

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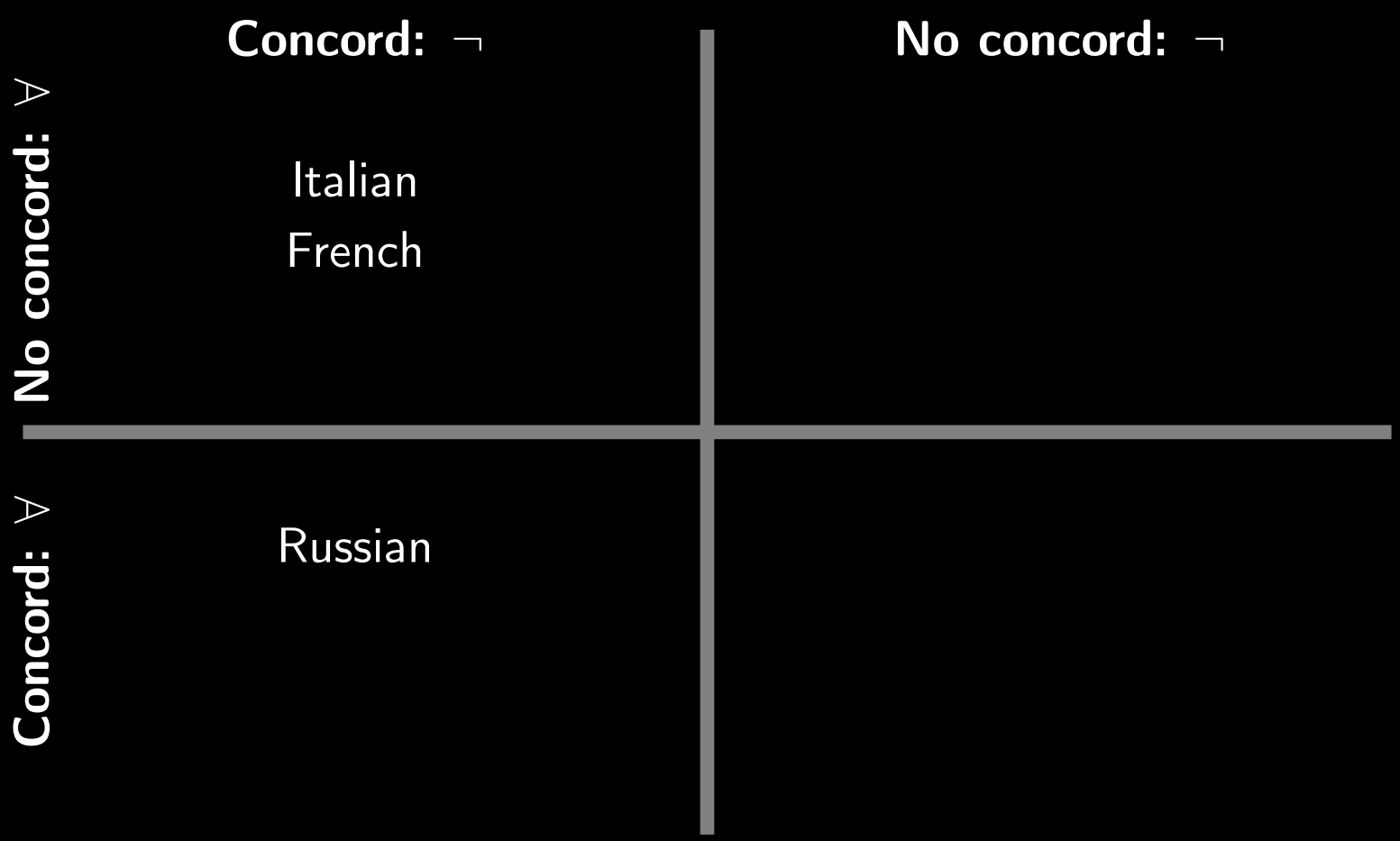

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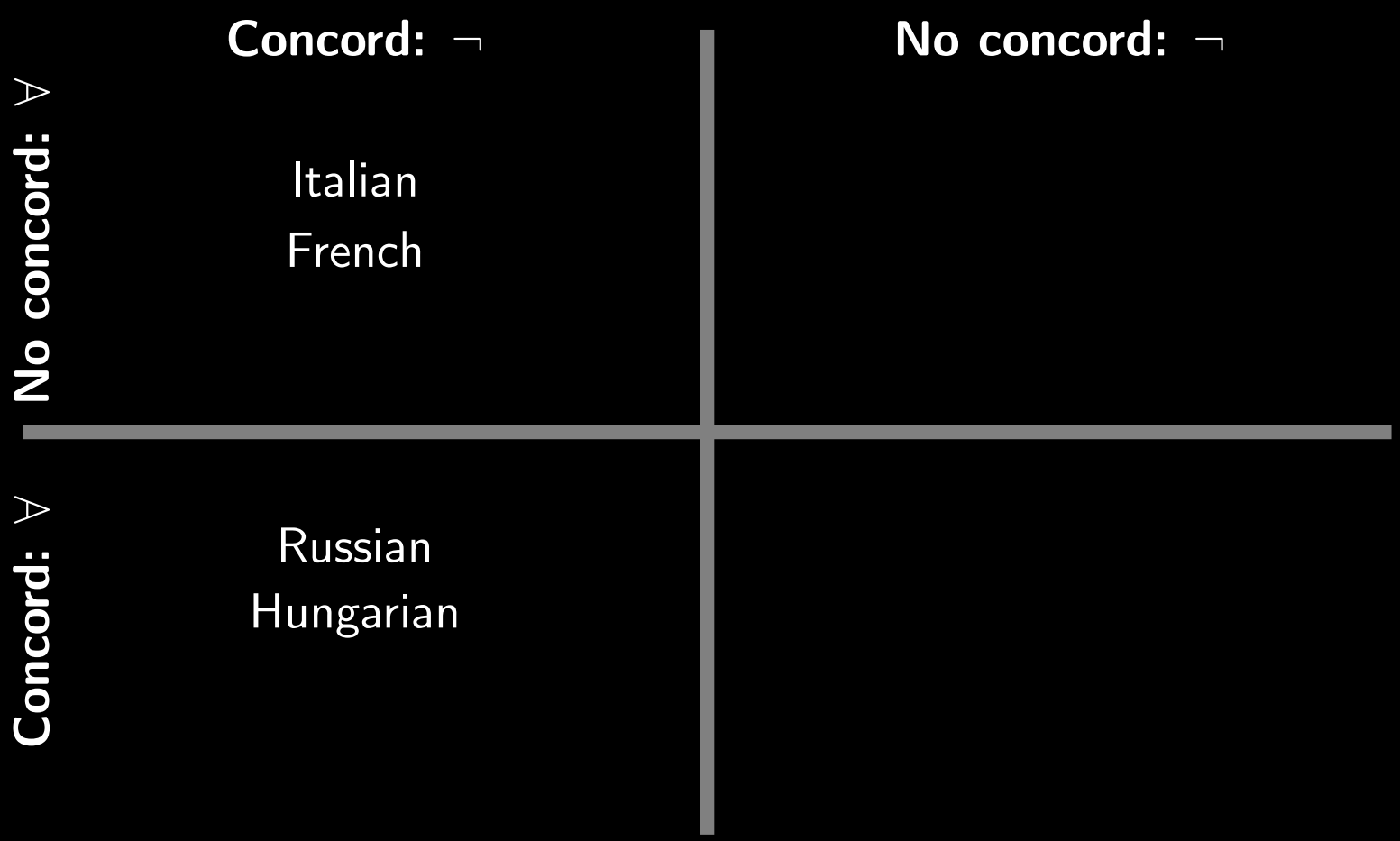

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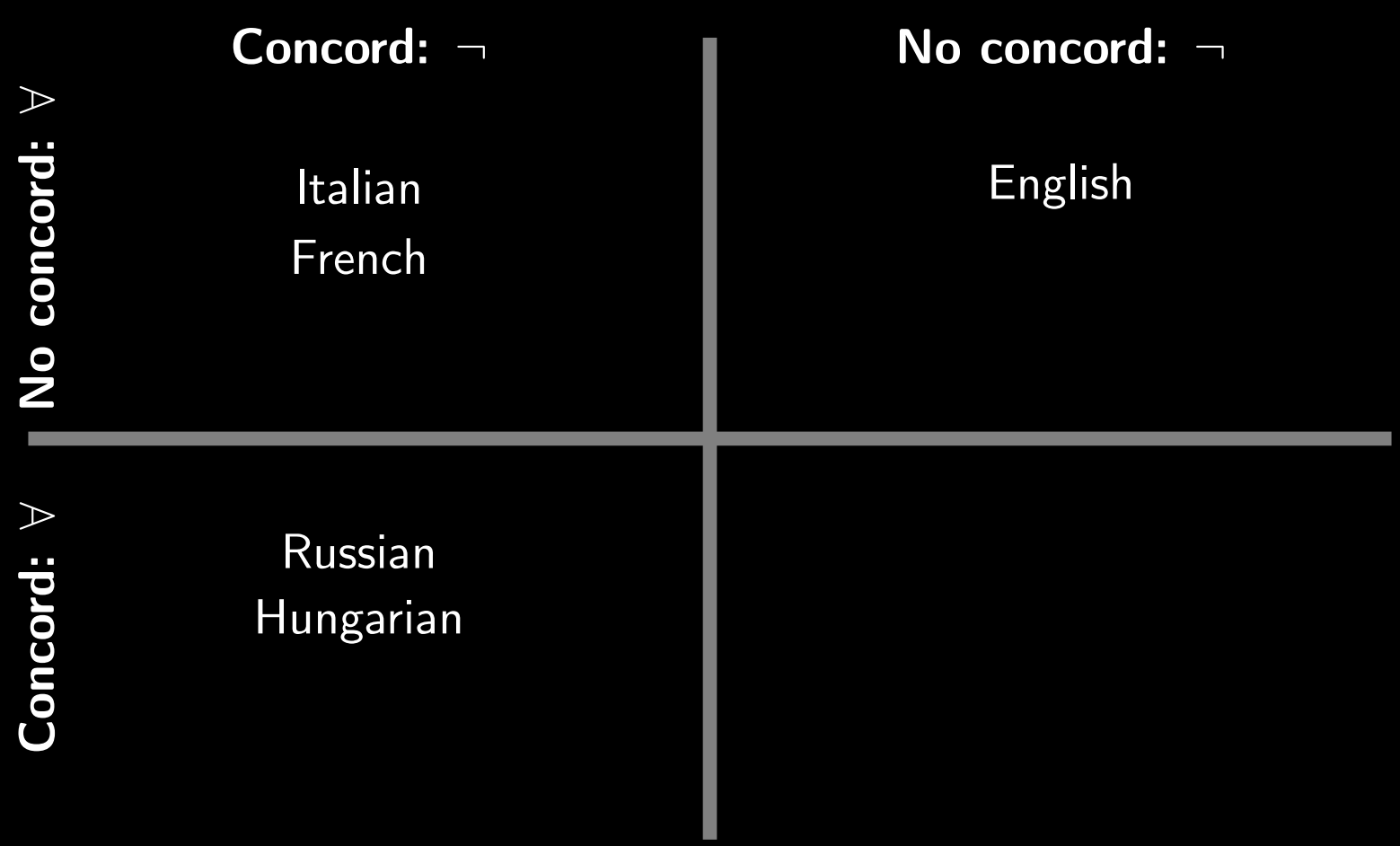

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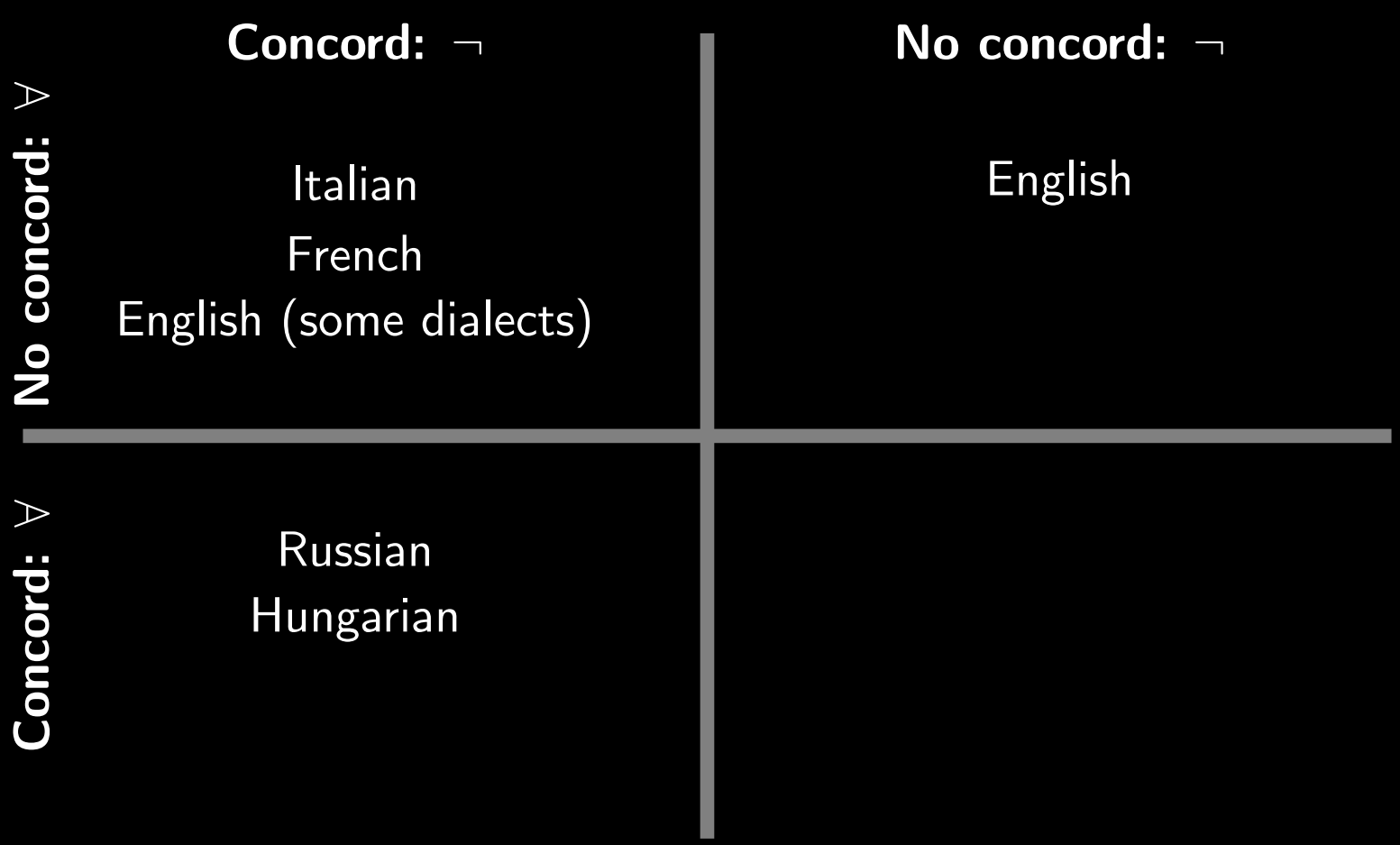

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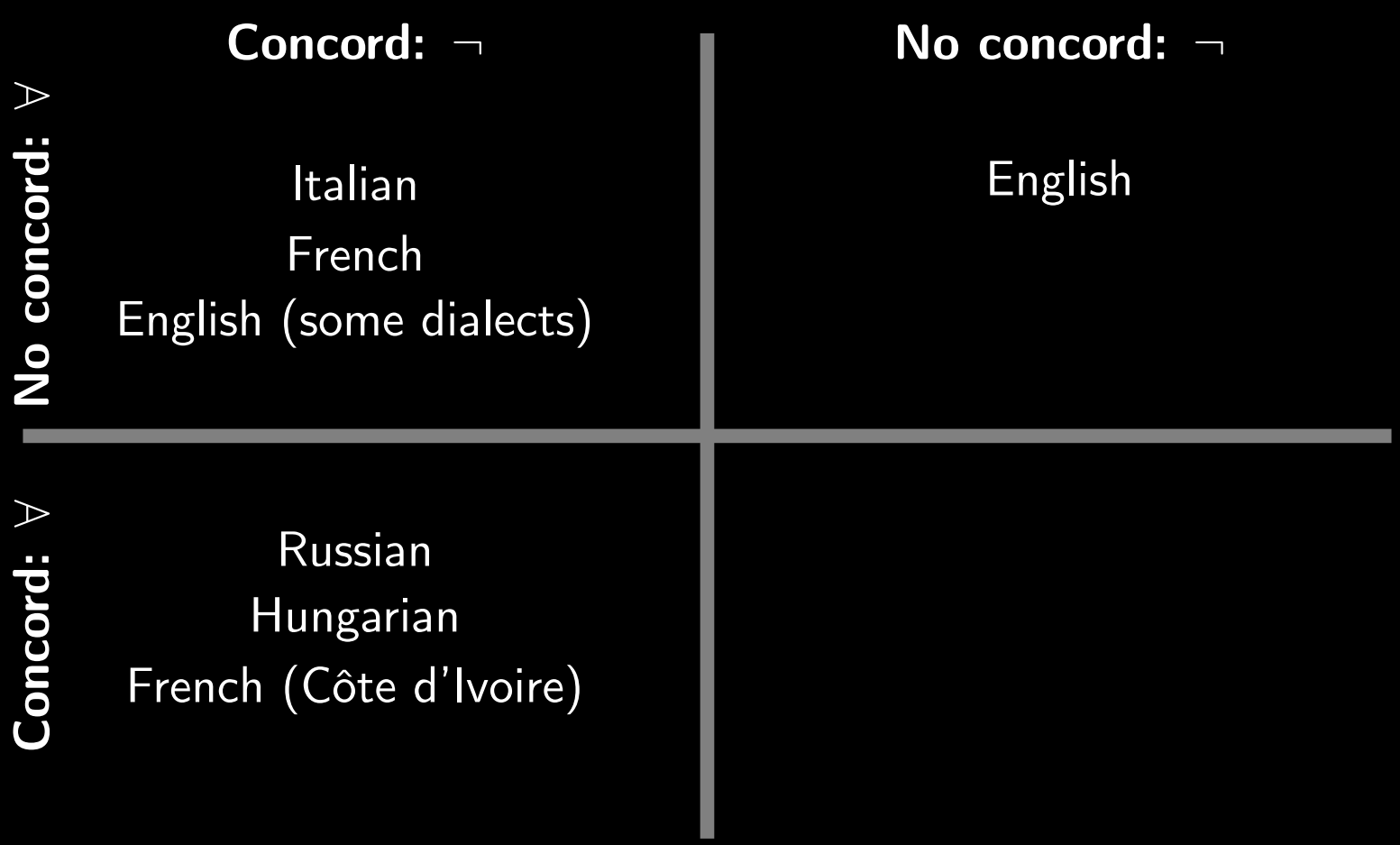

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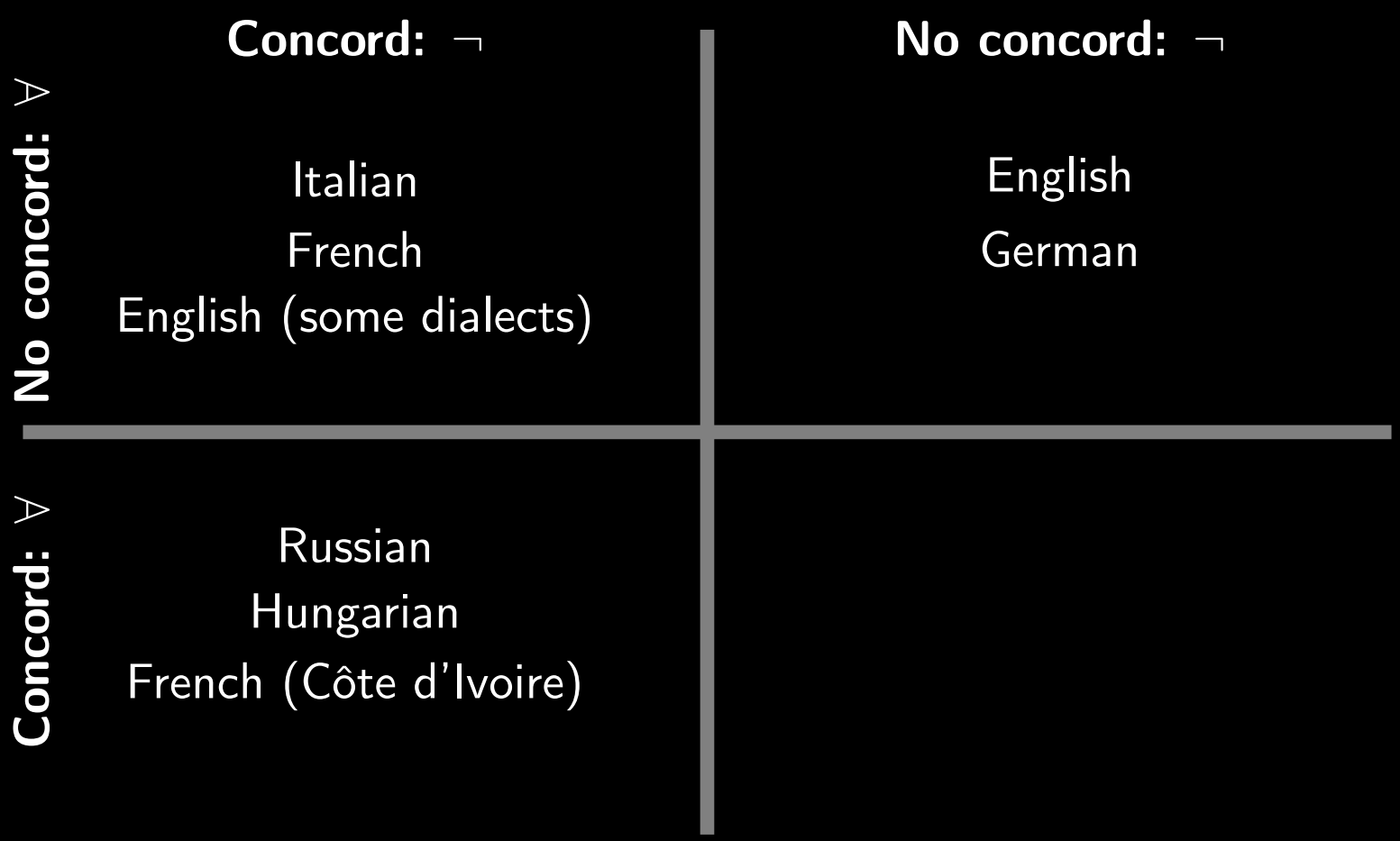

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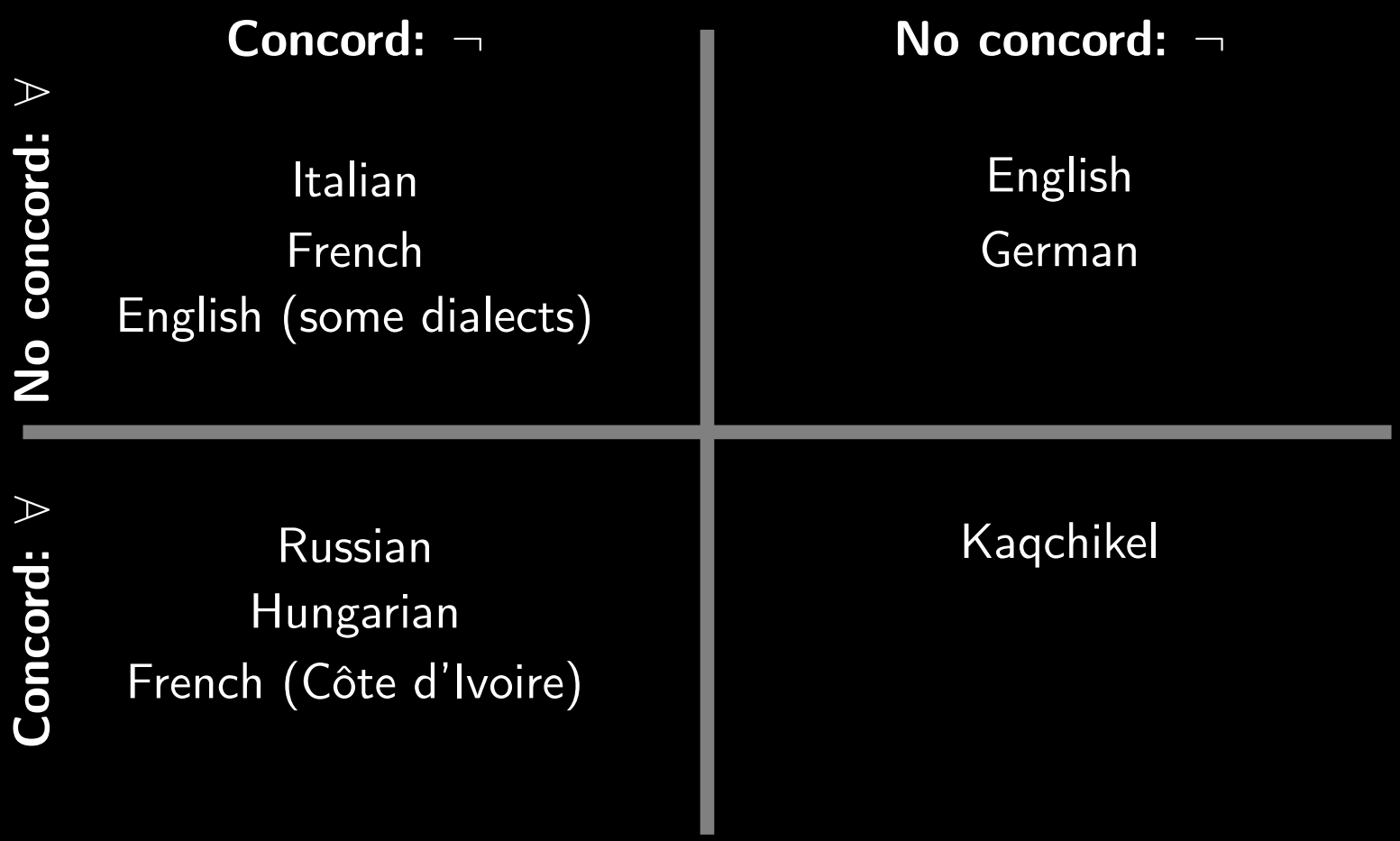

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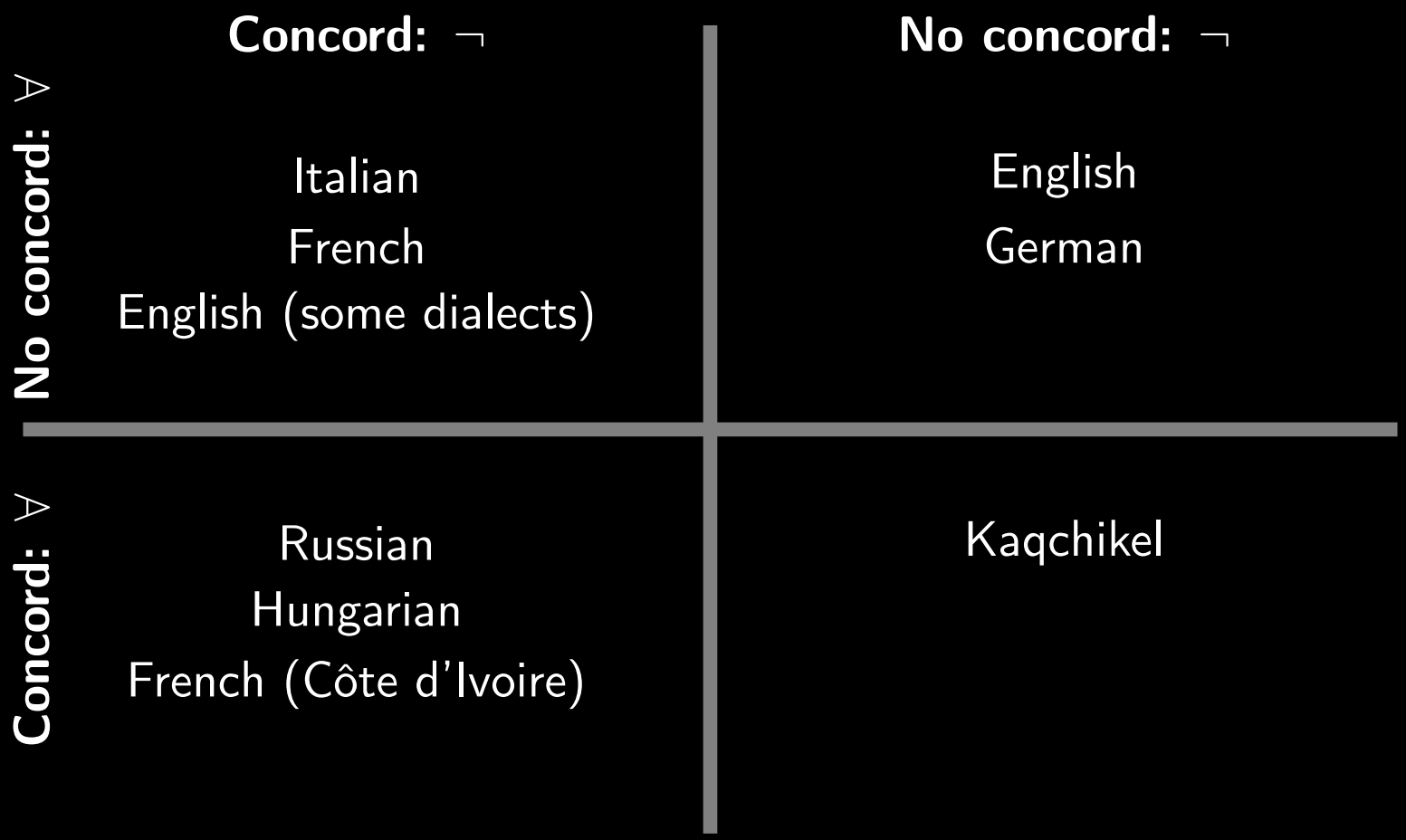


WALS: Spoken langs mostly ∀ concord (189 vs. 62); mostly ¬ concord (170 vs. 11)

Quantification

What about sign languages?

Quantification

- SLs frequently show NC involving non-manual signs.

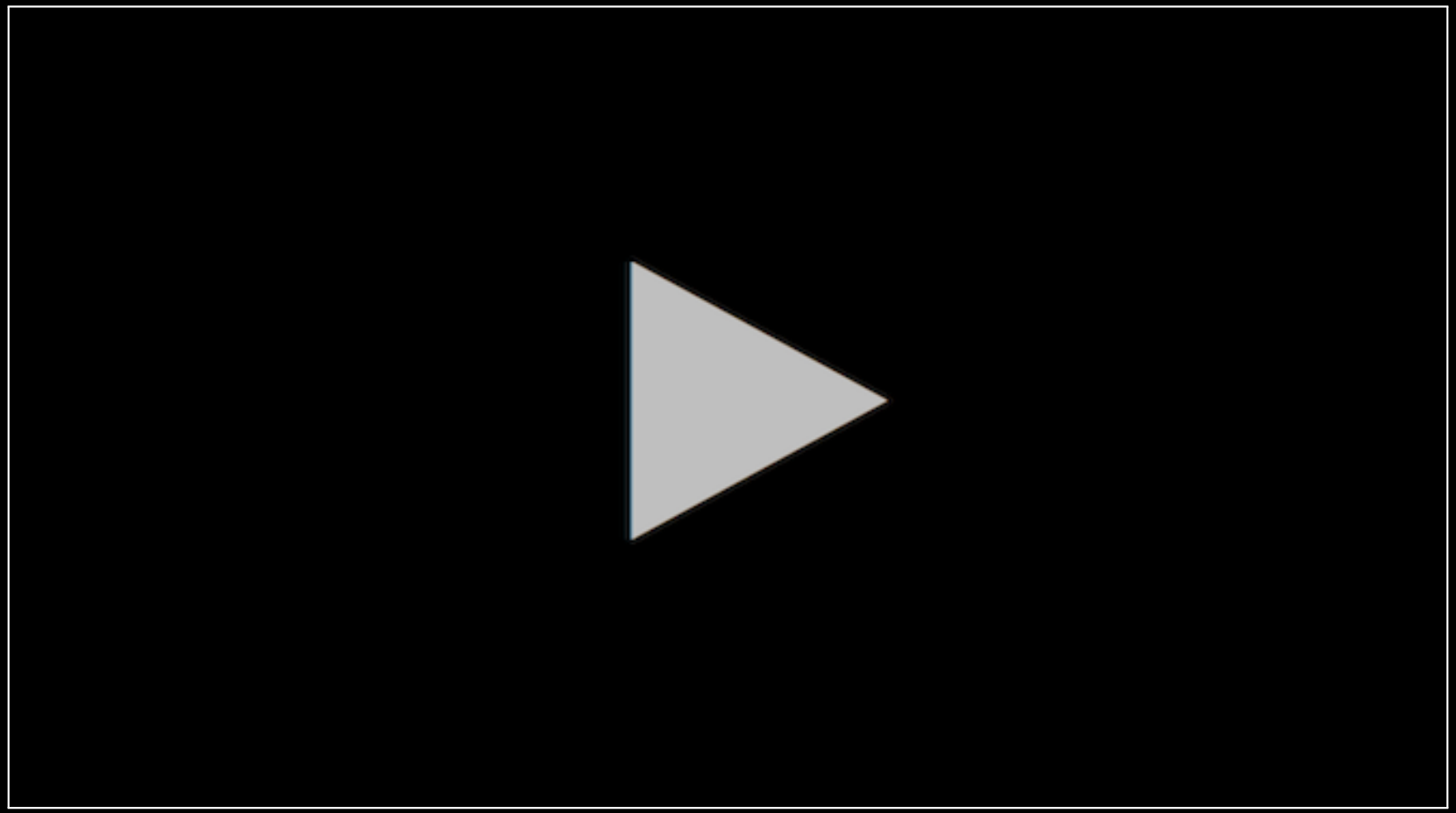
(10) a. * BOY $\overline{\text{LATE}}^{\text{NEG}}$.

b. BOY $\overline{\text{LATE NOT}}^{\text{NEG}}$.
'The boy is not late.' (RSL)

(11) a. IX-1 $\overline{\text{UNDERSTAND}}^{\text{NEG}}$.
'I don't understand.'

b. IX-1 $\overline{\text{NOT UNDERSTAND}}^{\text{NEG}}$.
'I don't understand.' (ASL)

Quantification



Quantification

- SLs rarely show NC involving only manual signs.

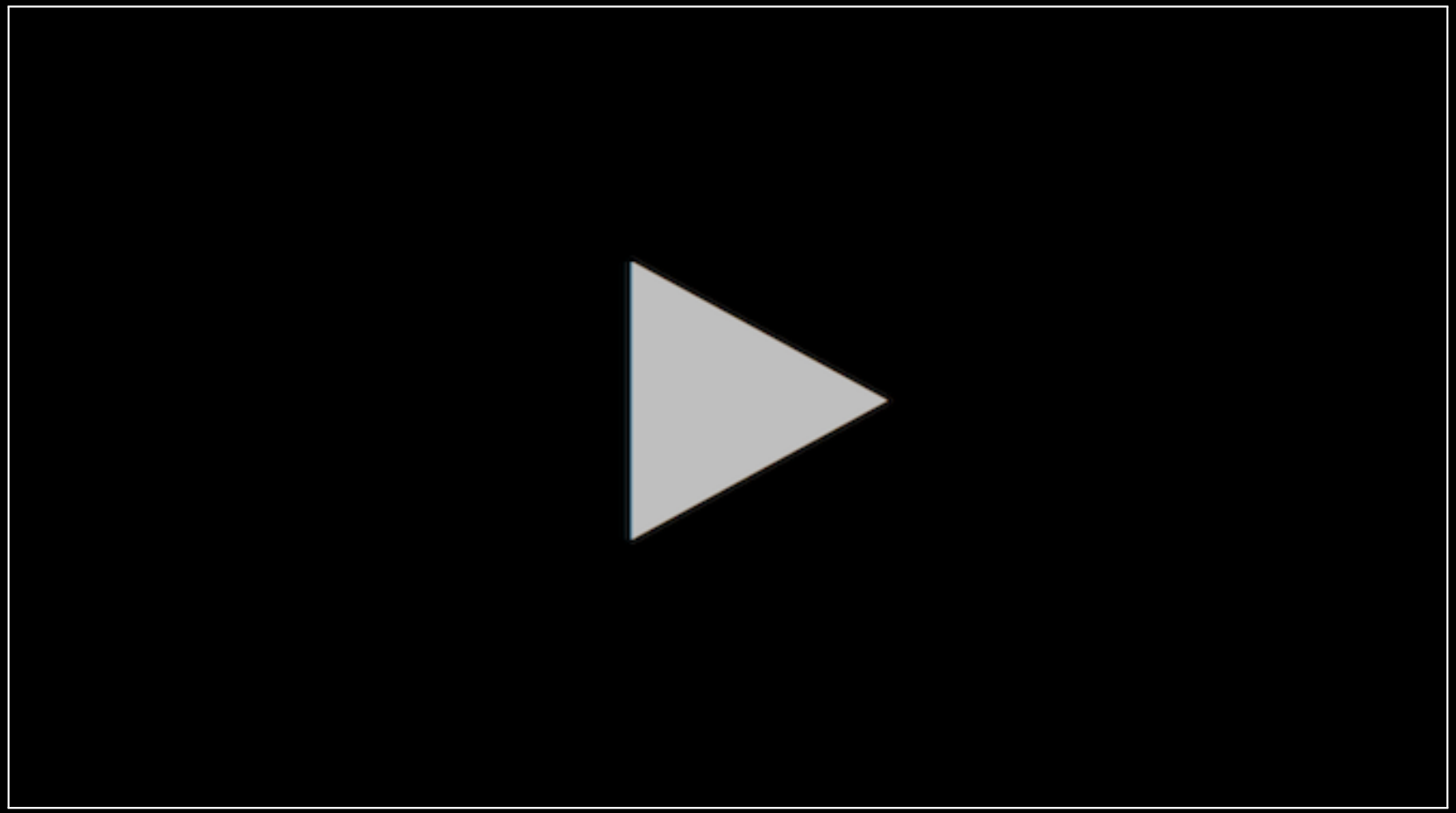
(12) a. CL-pl FRIENDS MINE OFFER NOTHING.
'My friends offered me nothing.'

b. NONE OFFER GIFT.
'Nobody offered me gifts.'

c. * NONE OFFER NOTHING. (LSF)

(13) Personne ne m'a rien donné. (French)

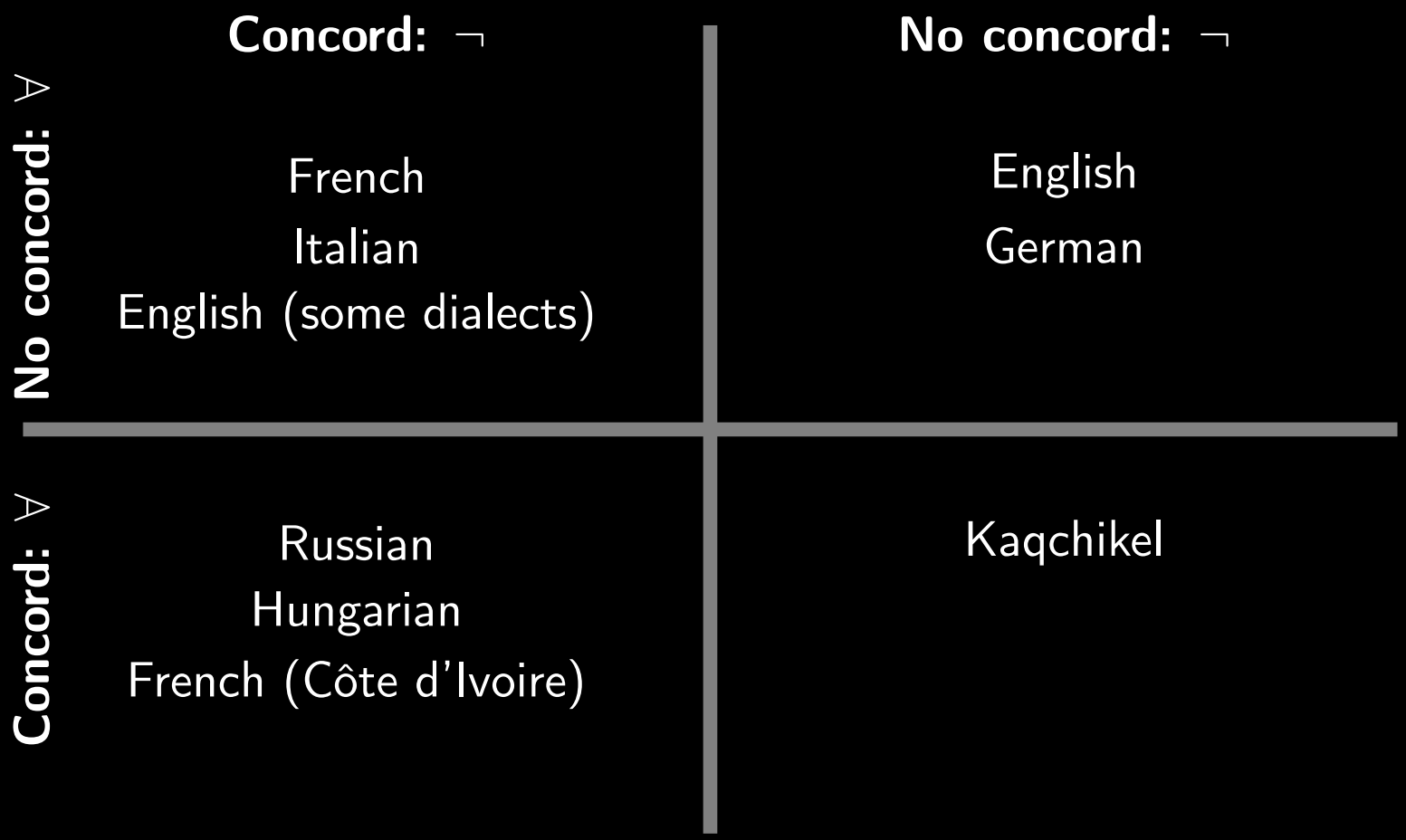
Quantification



Quantification

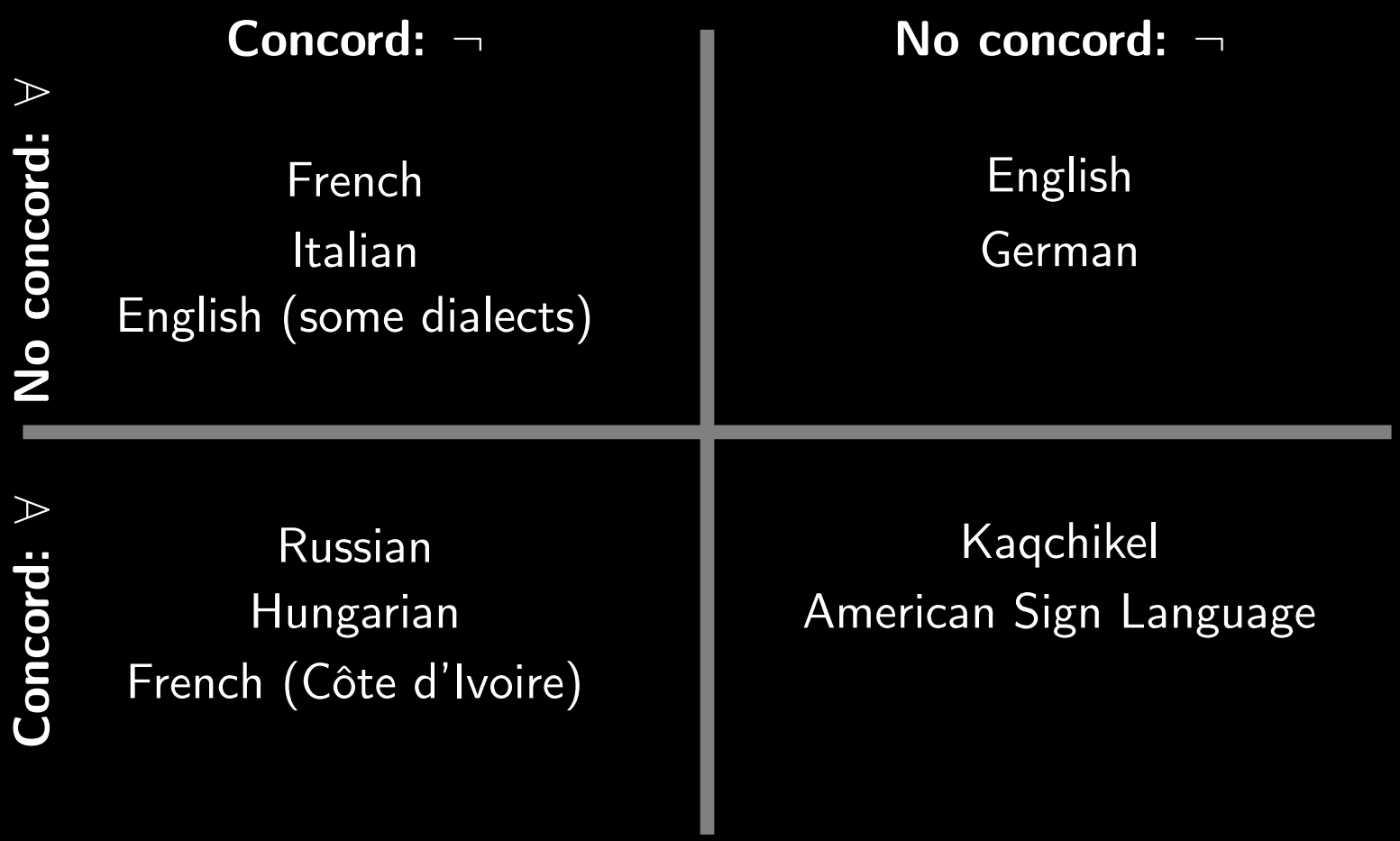
For now, I will categorize based on *manual signs*.

Quantification



WALS: Spoken langs mostly $\forall$ concord (189 vs. 62); mostly $\neg$ concord (170 vs. 11)

Quantification



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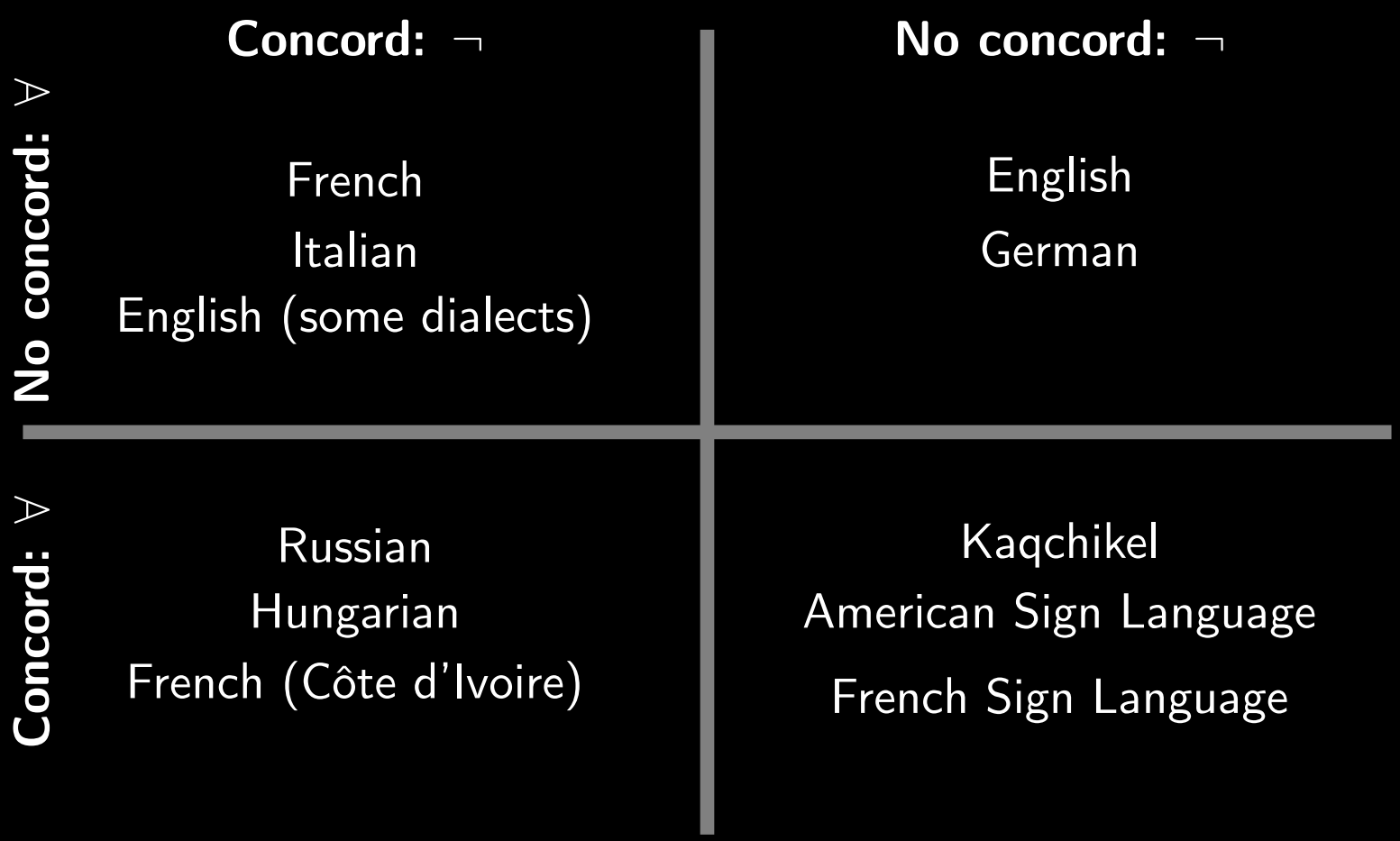

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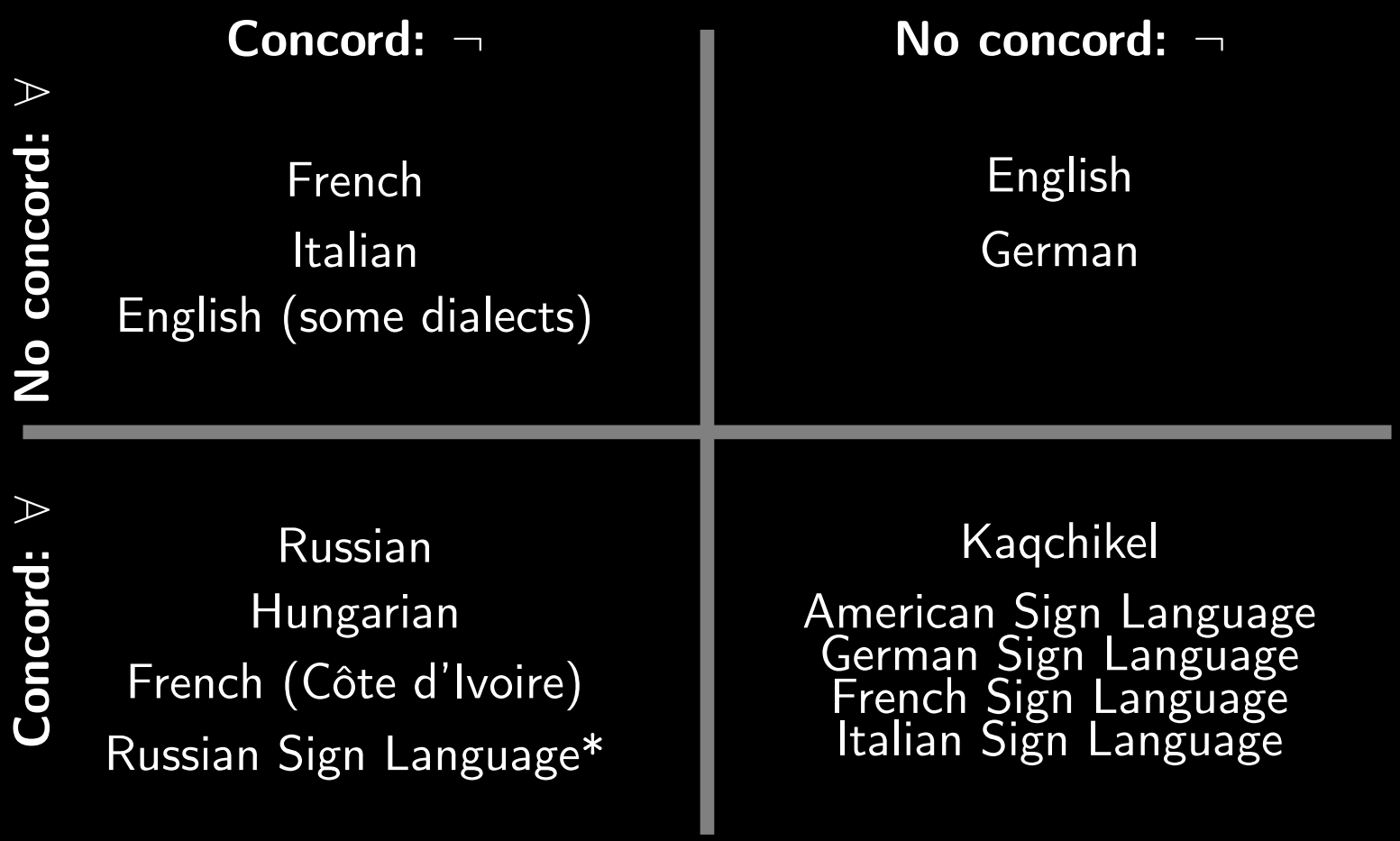

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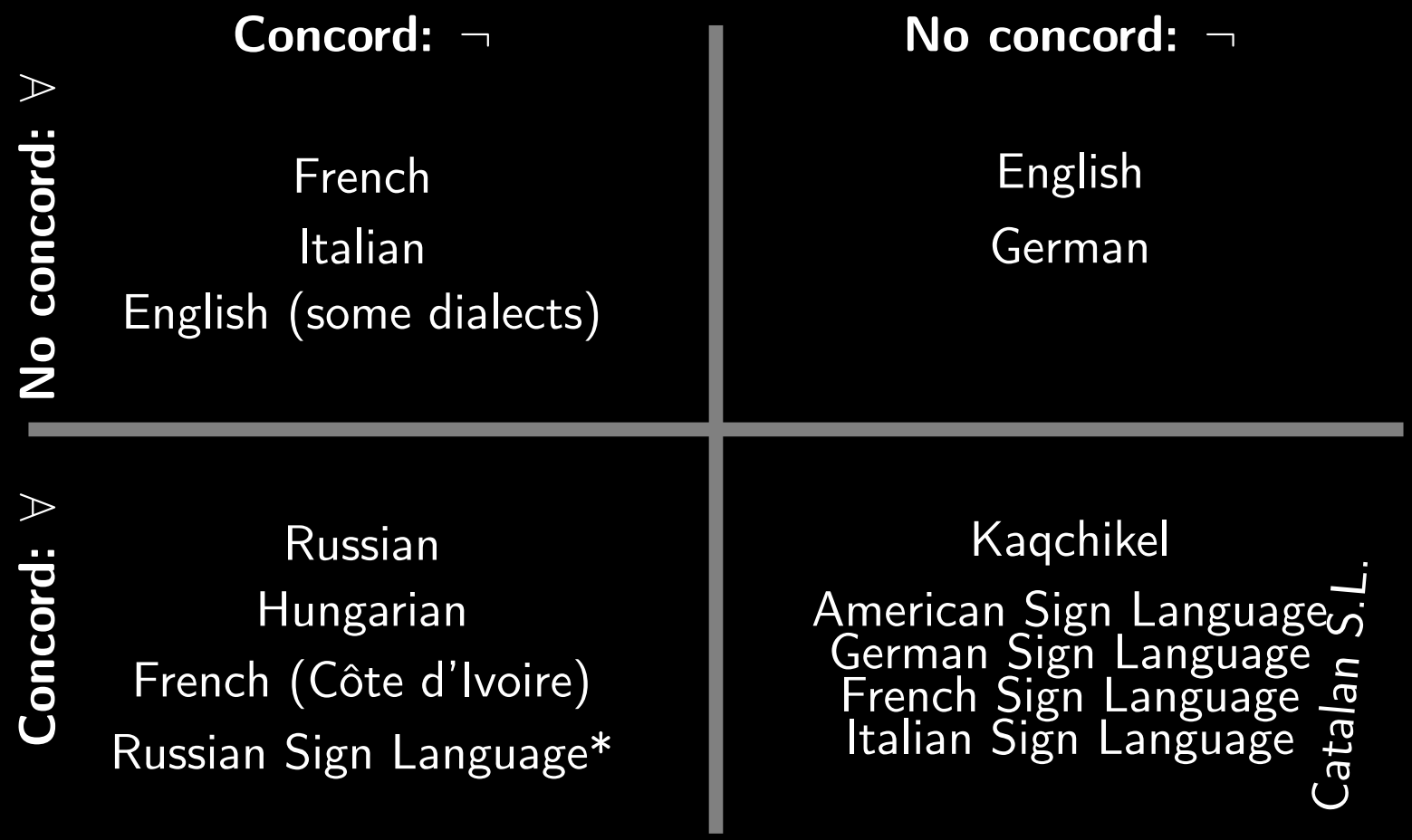

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Quantification

Zeshan (2004), based on 38 sign languages:

"The most common construction type here is double negative marking in the form of a negative particle plus a nonmanual negative marker. All sign languages seem to allow this construction, and in many cases it is the most common way of expressing negation. Sometimes the negative particle itself is repeated, ..., while the combination of two different manual negatives, such as a clause negator and a negative quantifier, is very uncommon."

Quantification

The question:
Why are sign languages mostly in that one corner?

Discourse reference

Hypothesis:
Concord is fundamentally linked to *discourse reference*.

(14) I saw a man in the road. He was whistling.

Discourse reference

Distributive concord is licensed only in environments that generate a plurality of discourse referents.

(15) Each professor nominated a student.
They could each win a 100 euro prize.

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(16) Minden gyerek hozott egy-egy könyvet.
Every(DIST) child brought one-DIST book.
'Every child brought one book.' (Hungarian)

The word *egy-egy* flags the fact that, later in evaluation, the discourse referent will be a plurality.

Discourse reference

Negative concord is licensed only in environments that block the introduction of discourse referents.

(17) a. I didn't see a student in the room.
??He was studying hard.

b. I went to the party without a date.
??He was wearing a tuxedo.

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(18) a. Je n'ai vu personne dans la salle. (French)

b. J'y suis allé sans personne.

The word *personne* flags the fact that, later in the derivation, the set of discourse referents will be empty.

The use of space

Discourse reference in sign language uses space.

- Individuals and sets are iconically represented.

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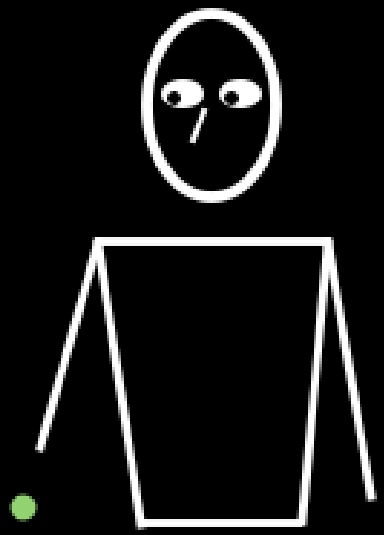

(19) JOHN ENTER.
HE HAPPY.

The use of space

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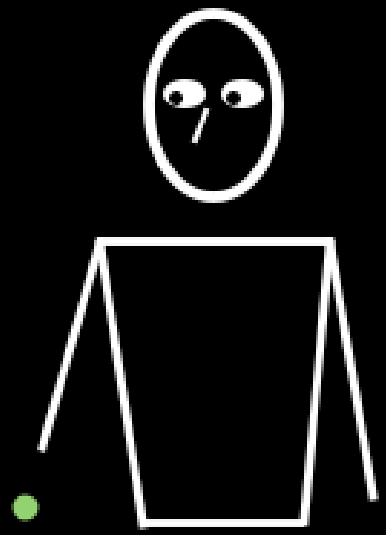
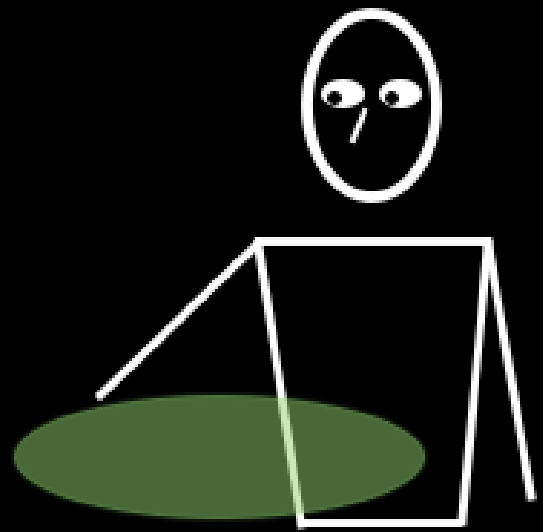


(19) JOHN ENTER.
HE HAPPY.

(20) MY FRIENDS ENTER.
THEY HAPPY.



The use of space

Let's go back to distributive concord...

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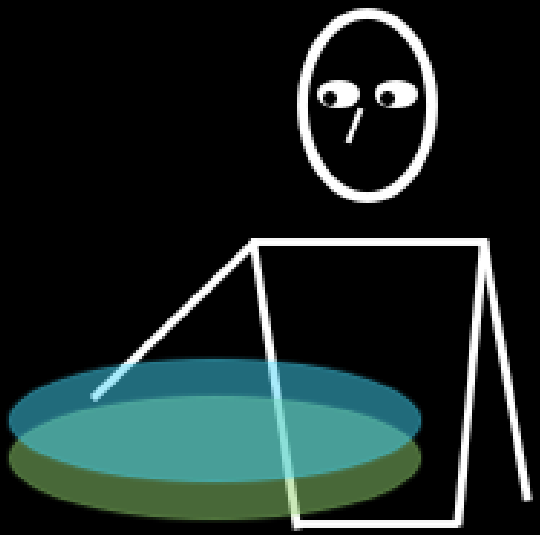

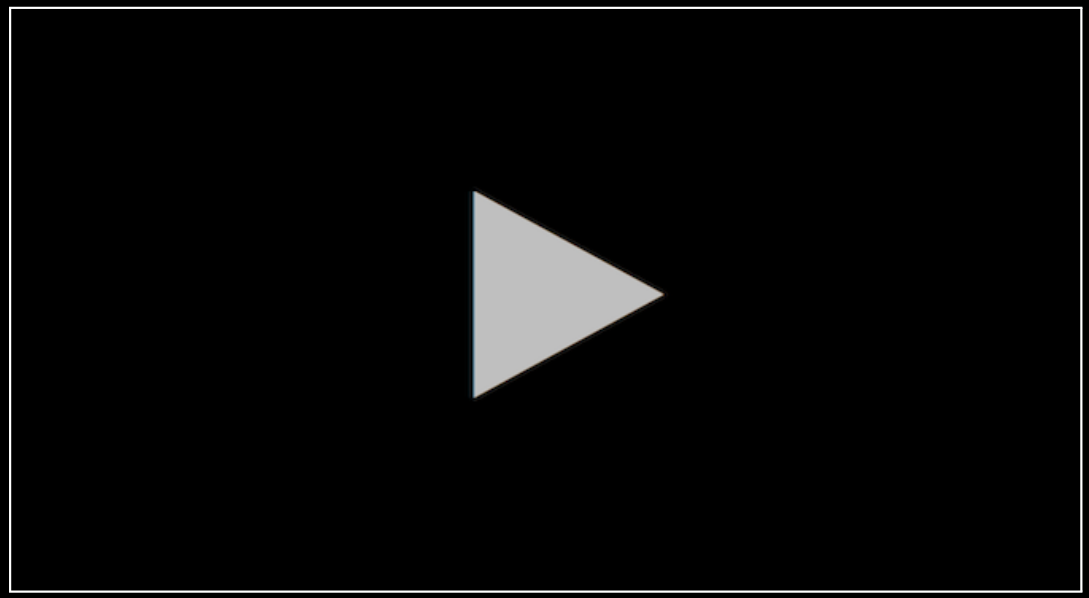

(21) BOY THEY READ ONE-arc BOOK.
'The boys (each) read one book.'

The use of space

So, how about negative concord?

The use of space

So, how about negative concord?

Here, there's a conflict!

- *The meaning of negative concord:*
  The set of discourse referents is empty.
- *Iconic impulse of sign language:*
  Dynamic information is represented in space.

The use of space

So, how about negative concord?

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- *The meaning of negative concord:*
  The set of discourse referents is empty.
- *Iconic impulse of sign language:*
  Dynamic information is represented in space.

You cannot demonstrate the non-existence of an entity by pointing at something.

The use of space

This pressure only holds for ***manual signs***.

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Recall:

- Negative concord with non-manuals = frequent
- Negative concord with manual signs = rare

The use of space

This pressure only holds for ***manual signs***.

Recall:

- Negative concord with non-manuals = frequent
- Negative concord with manual signs = rare

Why?

- Non-manual signs do not use space.
- No iconic pressure!

The use of space

Biases:

1. Avoid ineffability
2. Express quantification redundantly
3. Interpret space iconically

- This last pressure has a differential effect
  - Sign language different from spoken language
  - Manual signs different from non-manual signs

The use of space

Note: these are *biases*, not absolutes.

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When addressing typology, we talk about pressures:

- What is it easy for this language to do?
- What is it hard for this language to do?

The use of space

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When addressing typology, we talk about pressures:

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I claimed: *discourse reference* is central to concord.

- Quirky sign language typology is explained based on what it's *easy* and *hard* to represent in space.

Extensions

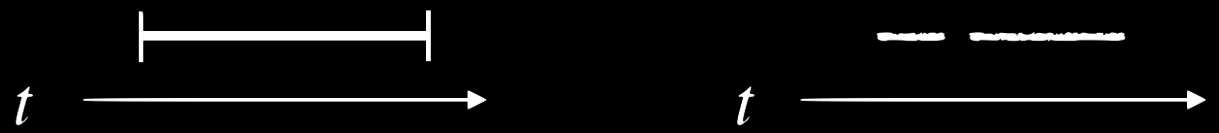
- If these biases are pre-linguistic, then they should be found experimentally for non-signers, too.
- We'll explore in another domain ... BOUNDARIHOOD.


Boundarihood

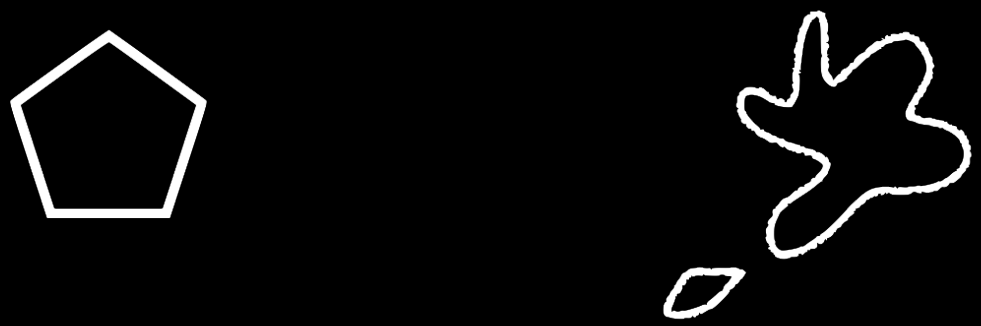
Boundarihood

A cognitively-grounded representation of **boundaries**.

Events



Objects



Boundarihood

- Boundarihood is associated with grammatical categories in many languages.
- In sign language, temporal boundaries are represented in the *form* of the sign.

Two types of verbs

Telic predicates
have a point of culmination

'reach the finish line'

Atelic predicates
no point of culmination

'run'

Two types of verbs

Natural language grammar encodes these categories.

- Telic predicates

  (22) a. 'John came to a decision **in** 30 minutes.'
  b. 'John finished his homework **in** 30 minutes.'

- Atelic predicates

  (23) a. 'John pondered the question **for** 30 minutes'
  b. 'John played with his friends **for** two hours'

Visible telicity in S.L.

- **Wilbur (2003):**
  Many sign languages systematically distinguish telicity in the phonological movement of a verb.
  - Telic verbs stop sharply, often with contact.
  - Atelic verbs have a continuous, extendable movement.

- More examples:

  Telic: ARRIVE, CLOSE, DIE, SIT-DOWN, GET-FULL
  Atelic: PLAY, WALK, WAIT, EXPLAIN, PONDER

Visible telicity in S.L.

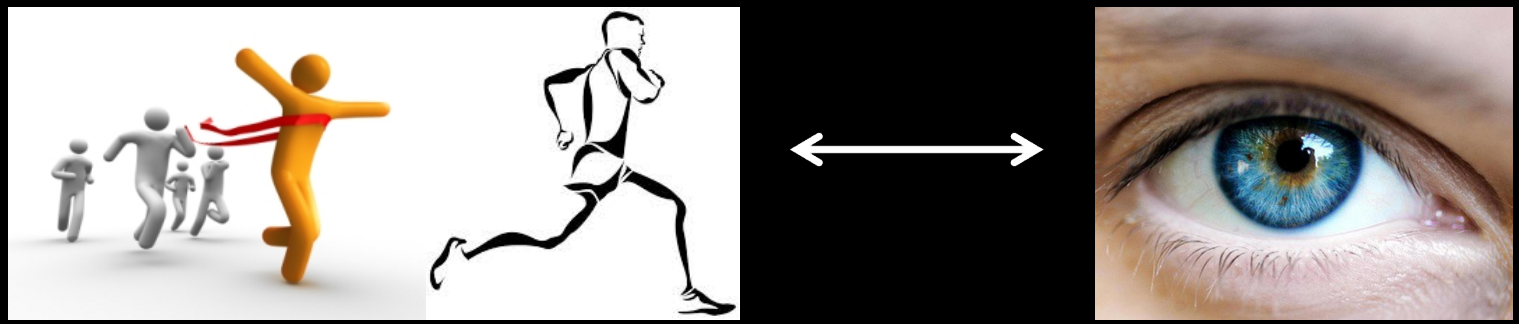
- There are exceptions (Davidson et al. 2019)
  - ASL: SLEEP, IMAGINE, THINK, STAY
- Best viewed as a **probabilistic** generalization

Why this tendency?

Question:
Why do sign languages encode telicity similarly?

Hypothesis:

- Pre-verbal, non-linguistic ability to map visual form to event structure.



Prediction

Prediction:

- Non-signers should be able to extract telicity from unfamiliar signs.

Experiment 1

(LIS sign: DECIDE)

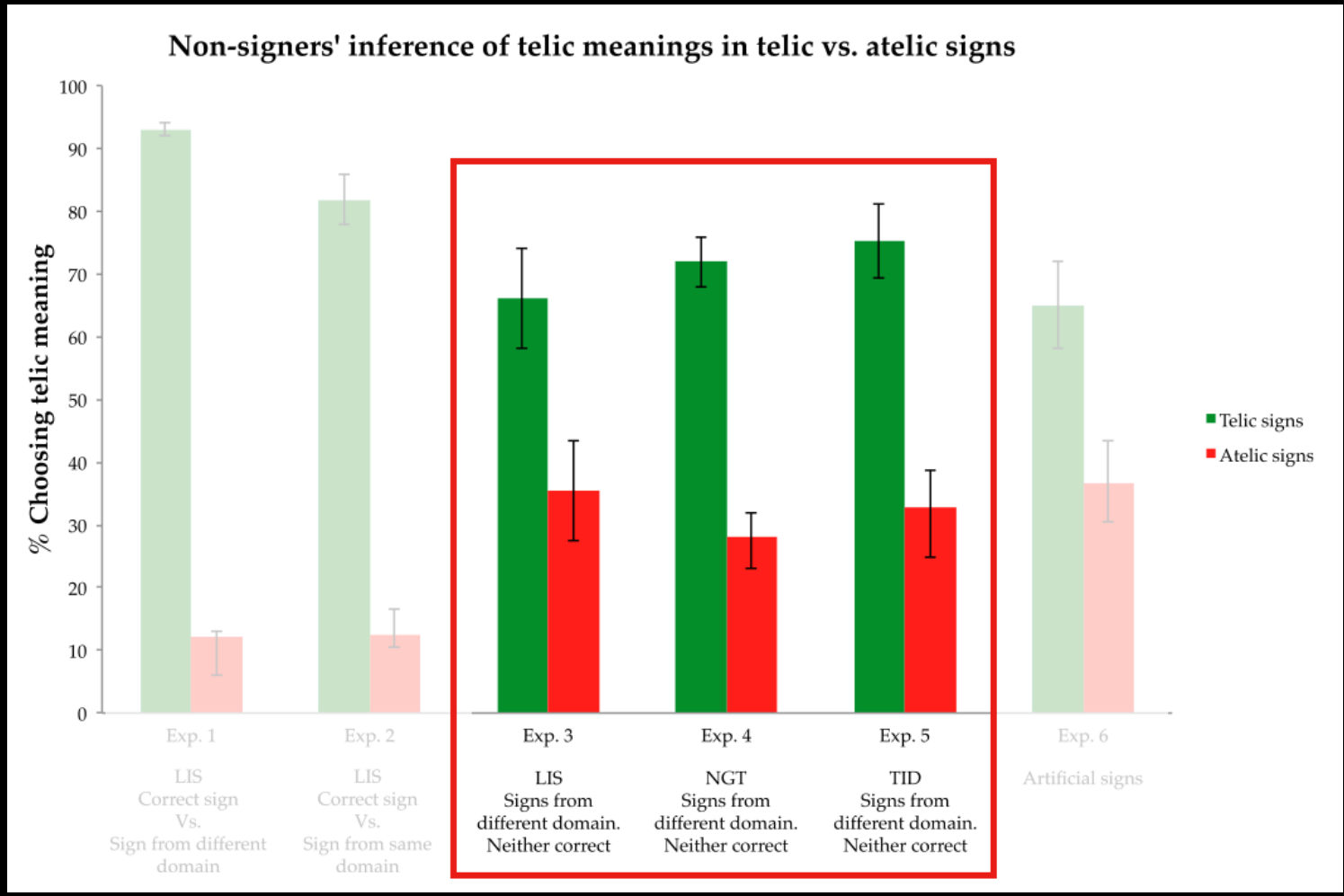
‘arrive’ ‘play’

Experiment 1

(LIS sign: TALK)

‘arrive’ ‘play’

Experiment 1



(Strickland et al. 2015)

Result #1

Finding:

- Non-signers can extract telicity of verbs from sign languages.

Conclusion:

- The probabilistic tendency to mark telicity in sign language **arises from non-linguistic biases**.

Domain generality

Question: Where does this mapping bias come from?

Possible answers:

1. It is specific to **gestural** boundaries and **events**.

Hyp. 1: event-specific

Zacks et al. (2007):

- Event segmentation via perceptual processing (especially visual processing).

Prediction: The motivated mapping above is specific to the **visual modality** and **temporal boundaries.**

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Domain generality

Question: Where does this mapping come from?

Possible answers:

1. It is specific to **gestural** boundaries and **events**.
2. General, representational **iconicity**.

Hyp. 2: Iconicity

- **Iconicity**: a structure preserving mapping.

Form		**Meaning**
bounded	$\leftrightarrow$	*bounded*
not bounded	$\leftrightarrow$	*not bounded*

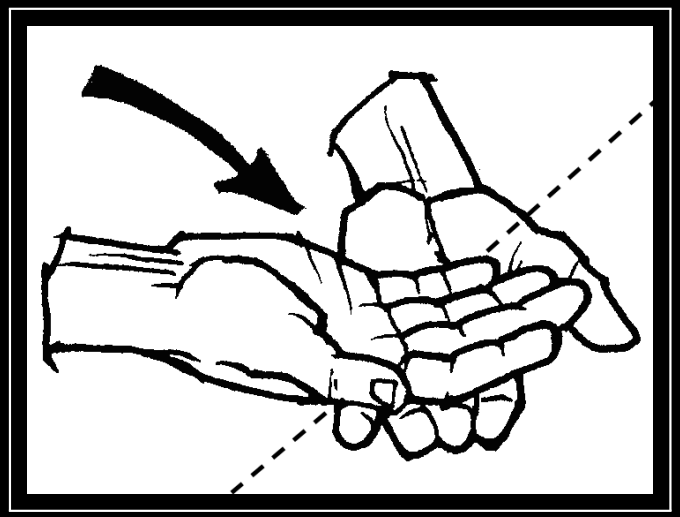
Prediction:
Extension to other domains with analogous structure.

Hyp. 2: Iconicity

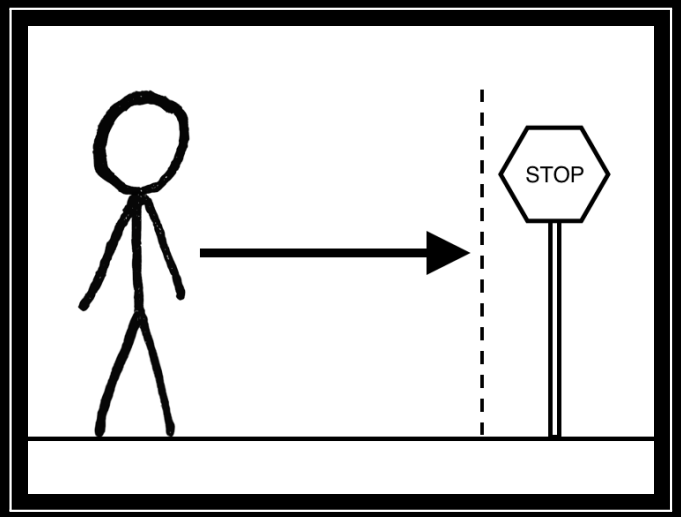
Meaning: not specific to eventive meanings

- Boundaries in time OR boundaries in space

Form



Meaning

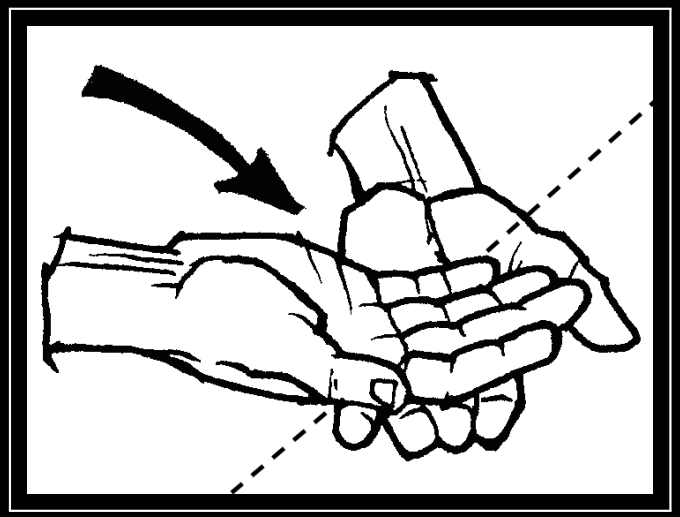


Hyp. 2: Iconicity

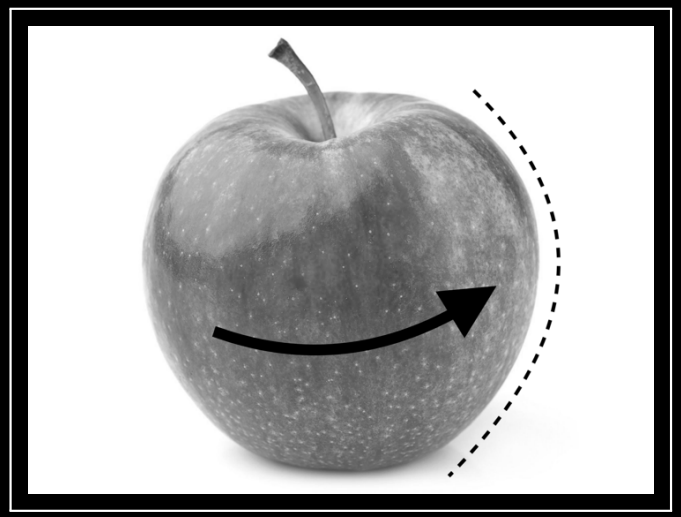
Meaning: not specific to eventive meanings

- Boundaries in time OR boundaries in space

Form



Meaning



Mass/count

- A conceptual distinction between objects and substances, even in early infancy. (Hespos et al 2009)

Object

Substance

Mass/count

- The **object/substance** opposition is correlated with the **count/mass** distinction of many languages.
- Count nouns:

  (24) too many trees *too much tree

- Mass nouns:

  (25) too much water *too many waters

Mass/count

Logical connections between telicity and mass/count.

Telicity

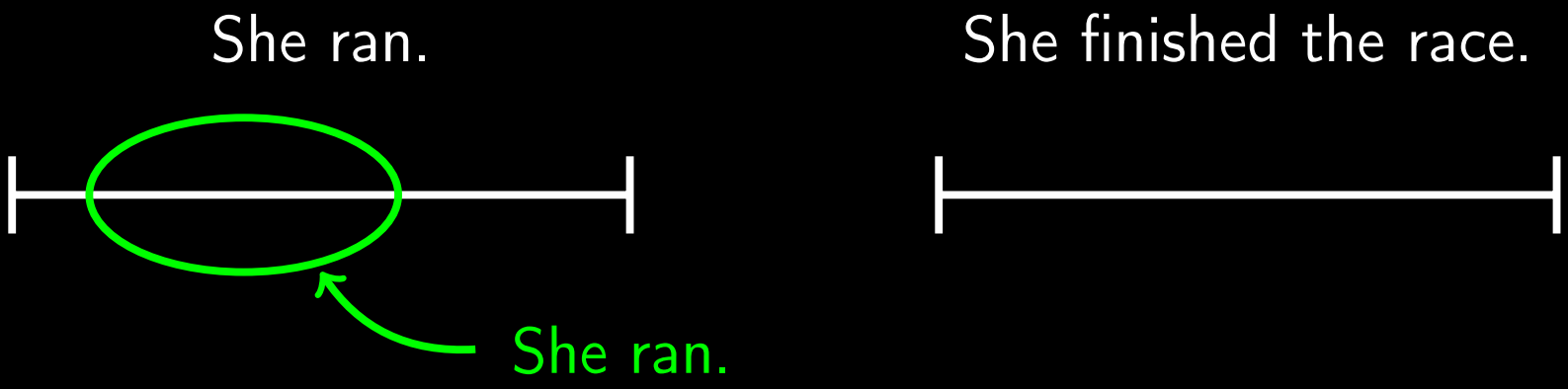
She ran.

She finished the race.

Mass/count

Logical connections between telicity and mass/count.

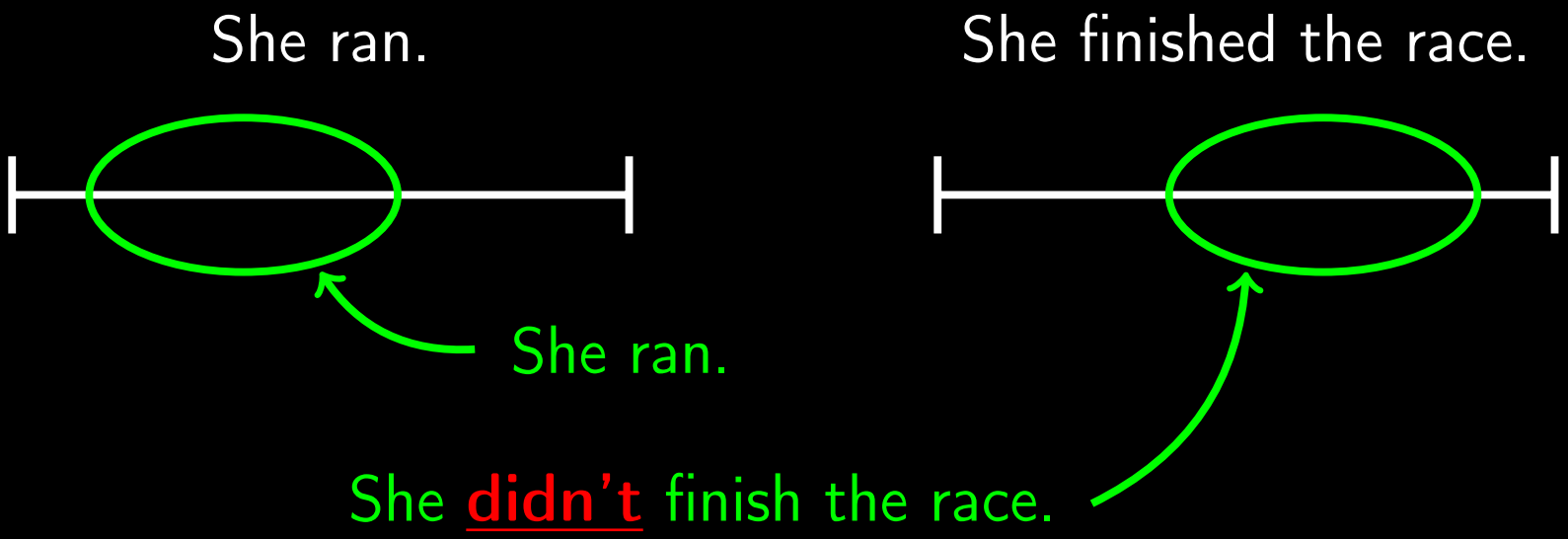
Telicity



Mass/count

Logical connections between telicity and mass/count.

Telicity



Mass/count

Logical connections between telicity and mass/count.

Mass/Count

water

tree

Mass/count

Logical connections between telicity and mass/count.

Mass/Count

water

tree

Mass/count

Logical connections between telicity and mass/count.

Mass/Count

water

water

tree

not a tree

Mass/count

- Motivation to test the bias in the nominal domain.

Experiment 2

(LIS sign: DECIDE)

‘apple’ ‘water’

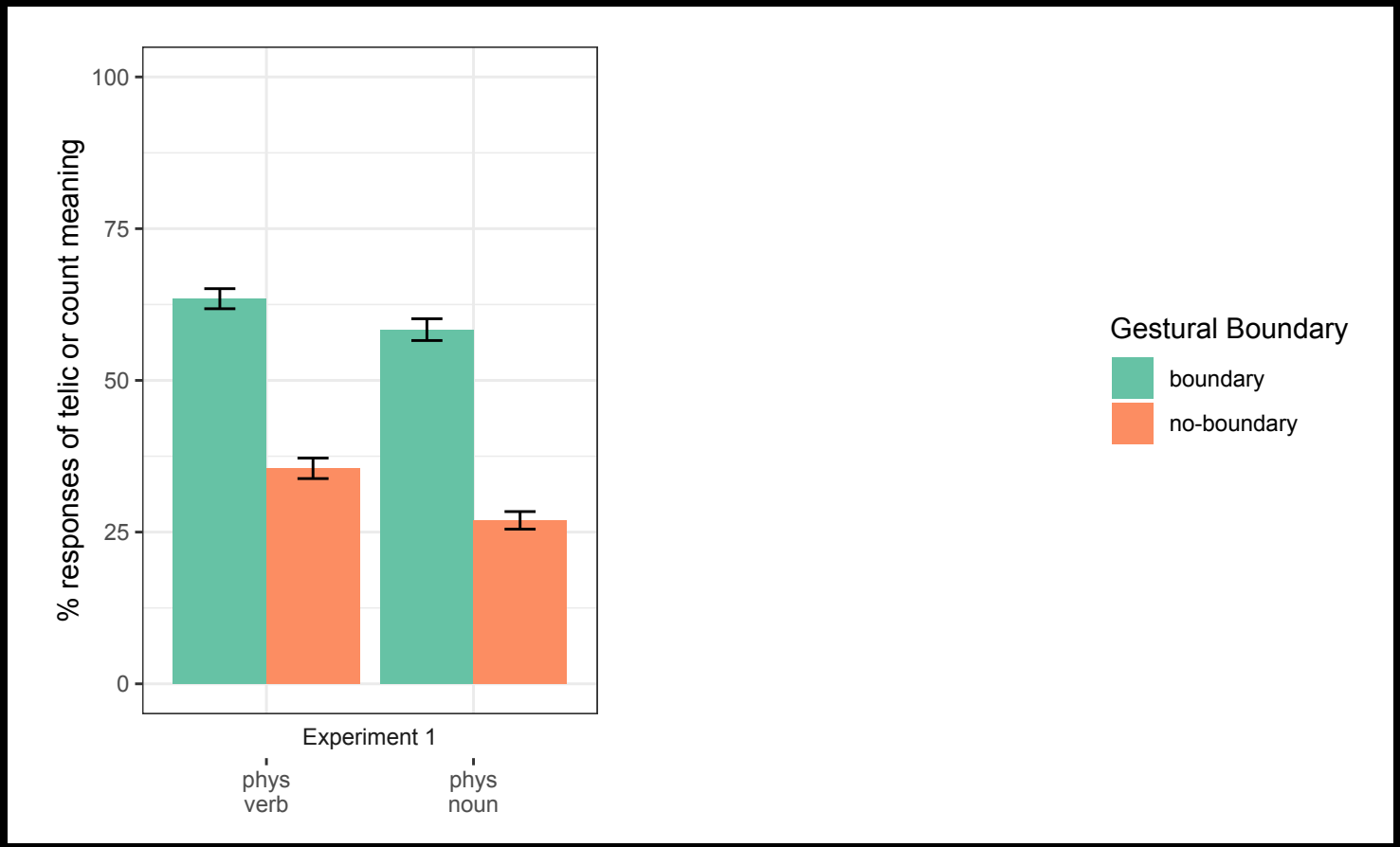
Experiment 2

(LIS sign: TALK)

‘apple’ ‘water’

Exp. 2: Results

Italian SL; physical **count** **vs.** **mass** nouns



Result #2

Finding:

- The same bias appears for nouns as well as verbs.

Conclusion:

- The bias is built from general, iconic associations.

Grammar or concepts?

Question:
Is the mapping bias acting on **grammar** or **concepts**?

Concepts & grammar

Conceptual representations *bias* grammatical categories, but this is not a one-to-one association

- English *spinach* is mass; French *épinard(s)* is count

Inagaki & Barner (2009):

- Concepts that vary in grammatical encoding are those with **unclear conceptual categorization**.

Psych words

Systematically the case for **psychological nouns**.

- May be categorized as mass or count:
  - *knowledge* is mass
  - *idea* is count
- But ... what is the boundary of an idea??

Psych words

Systematically the case for **psychological nouns**.

- May be categorized as mass or count:
  - *knowledge* is mass
  - *idea* is count
- But ... what is the boundary of an idea??
- We verified this intuition for verbs and nouns.

Psych words

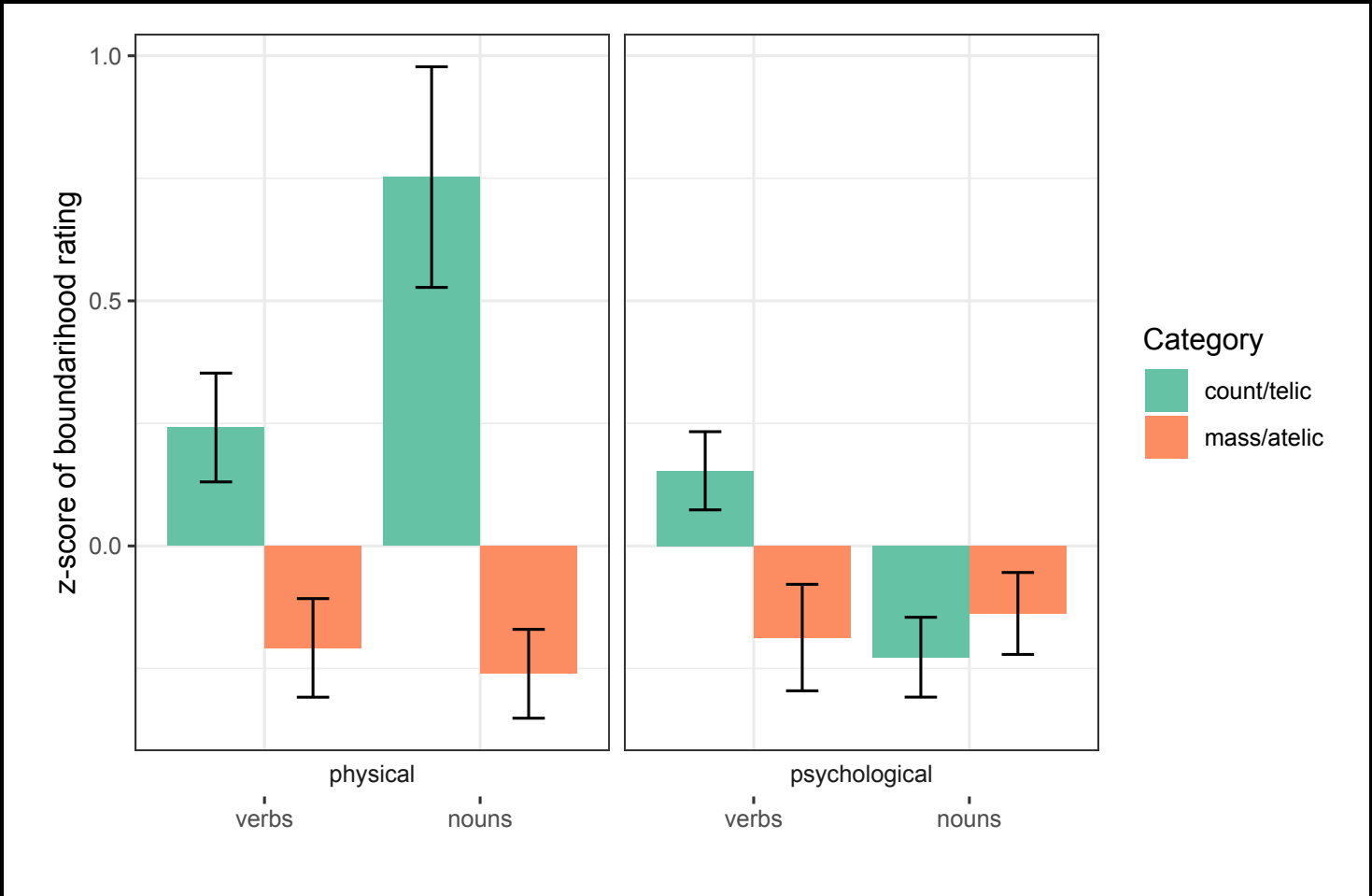
Norming study:

(26) Consider something that you could describe with the following word:

coin

Does what is described have a **clear and stable boundary**?

Psych words


1.0
0.5
0.0
z-score of boundarihood rating
physical
psychological
verbs
nouns
verbs
nouns
Category
count/telic
mass/atelic

Psych words

A difference between verbs and nouns:

- Telic verbs, physical or psych, are bound in time.
- Physical count nouns are bound in space, but psychological count nouns are not.

	Verbs	**Nouns**
Physical	✓ ‘arrive’ ‘play’	✓ ‘apple’ ‘sand’
Psychological	✓ ‘decide’ ‘ponder’	✗ ‘idea’ ‘knowledge’

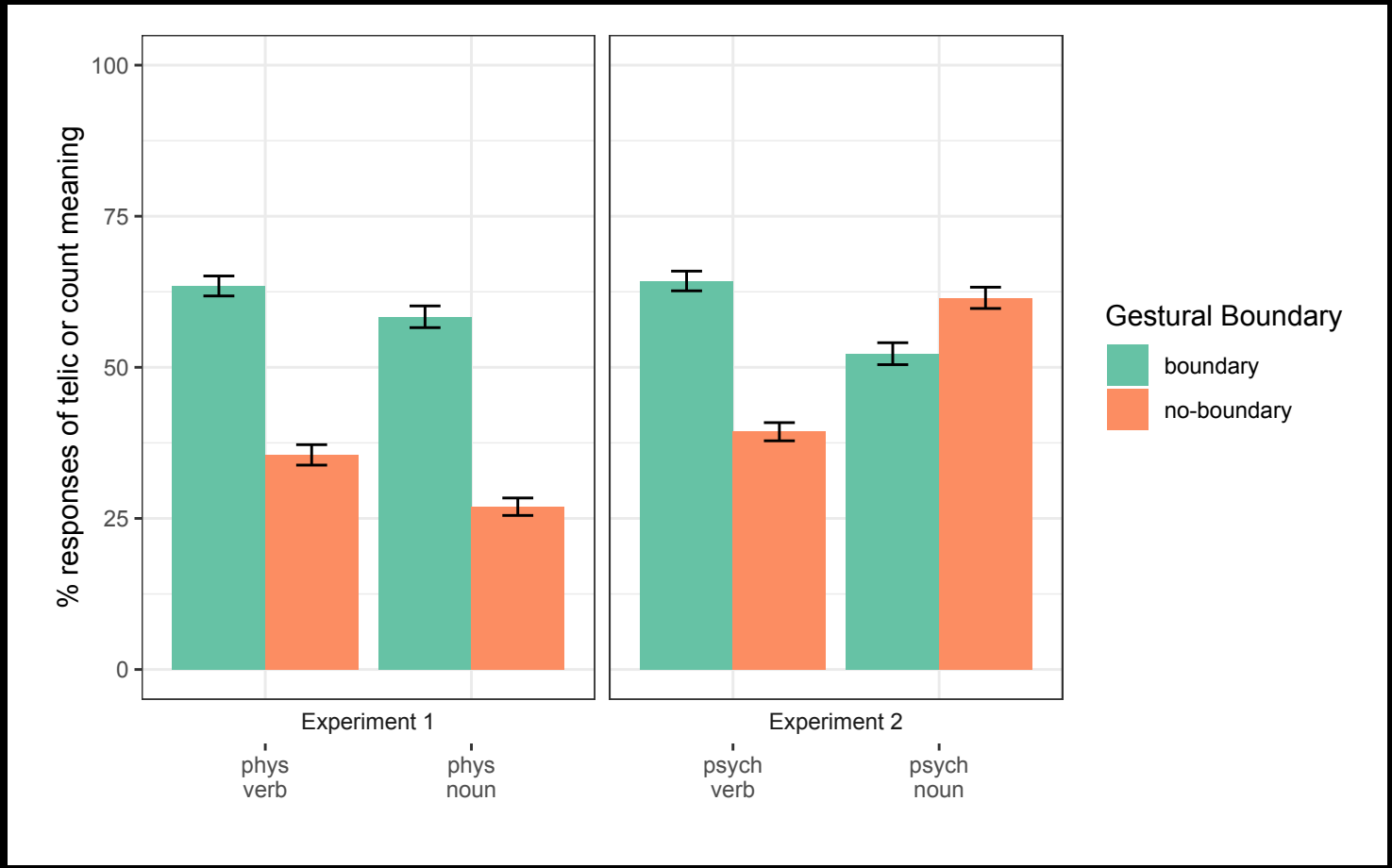
Grammar or concepts?

Question:
Is the mapping bias acting on **grammar** or **concepts**?

- **Hypothesis 1:** It acts on *grammatical categories*.
  - *Prediction:* An effect for psychological nouns, too.
- **Hypothesis 2:** It acts on *conceptual representations*.
  - $\rightarrow$ It should hold to the extent that boundarihood is relevant in a conceptual domain.
  - *Prediction:* No effect for psychological nouns.

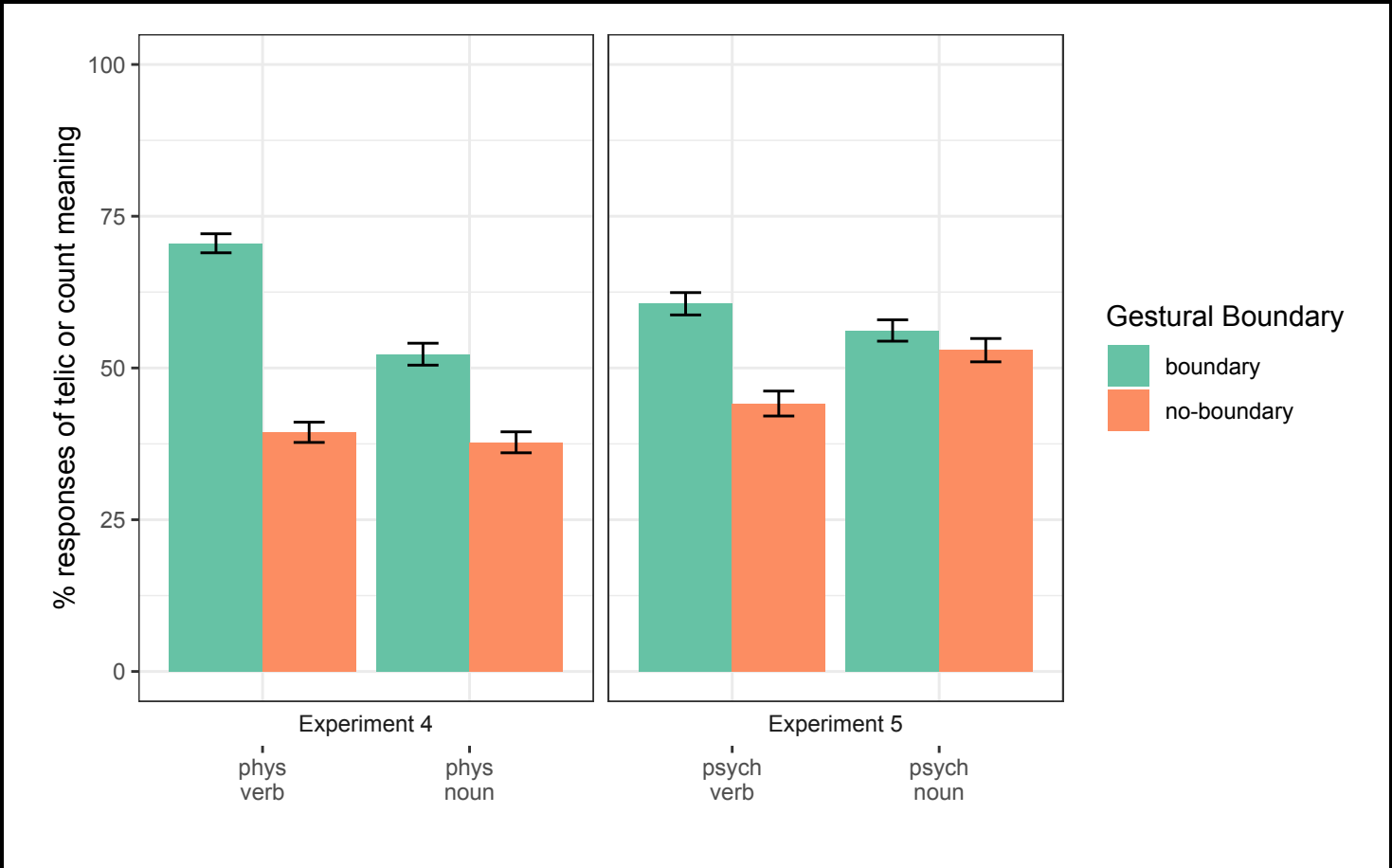
Exp. 3: Results

A. LIS signs:



Exp. 3: Results

B. Fake signs:



Result #3

Finding:

- The mapping bias disappears for psychological nouns (but not for psych verbs).

Conclusion:

- The iconic mapping operates on conceptual representations, not on linguistic features.

Summary

Starting point: probabilistic tendency of sign language

Results:

Summary

Starting point: probabilistic tendency of sign language

Results:

#1 This tendency arises from non-linguistic biases.
('Non-signers, too')

Summary

Starting point: probabilistic tendency of sign language

Results:

#1 This tendency arises from non-linguistic biases.
('Non-signers, too')

#2 These biases employ general iconic mappings.
('Nouns as well as verbs')

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('No effect for psych nouns')

Summary

Starting point: probabilistic tendency of sign language

Results:

#1 This tendency arises from non-linguistic biases.
('Non-signers, too')

#2 These biases employ general iconic mappings.
('Nouns as well as verbs')

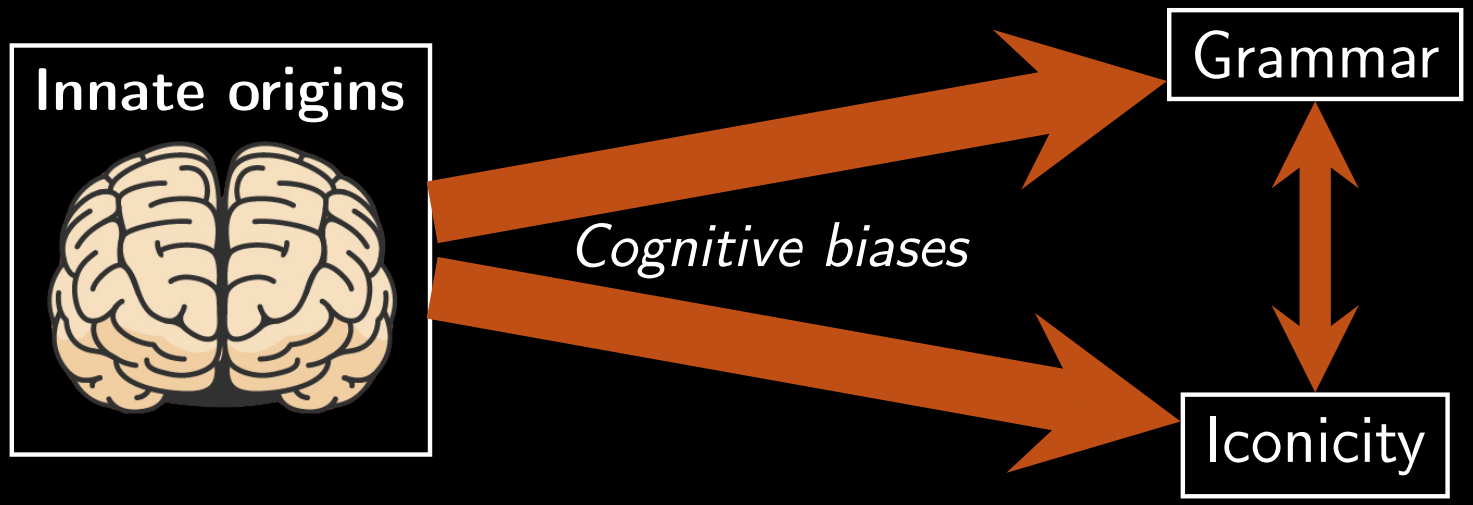
#3 The mappings operate on concepts, not grammar.
('No effect for psych nouns')


Conclusion

Discussion

The interaction of cognition, grammar, and iconicity:

- Grammar and iconicity are two separate, if interacting, communicative systems
- Cognitive biases influence both.



Conclusion

- We started with generalizations from sign language.
  1. Typology of quantification
  2. Visually-represented telicity
- Cognitive representations influence iconic forms.
  - Even for abstract, logical representations.
- Iconicity imposes a bias on the form of language.
- Language, and iconicity, can serve as a window into cognition.

Kuhn. (2020). Logical meaning in space: Iconic biases on quantification in sign languages. *Language*, 96(4), e320-e343.

Kuhn, Geraci, Schlenker, and Strickland. (2021). Boundaries in space and time: Iconic biases across modalities. *Cognition*, 210, 104596.

Preprints of both on my website: www.jeremykuhn.net

References I

Hespos, S., Ferry, A., and Rips, L. (2009). Five-month-old infants have different expectations for solids and substances. *Psychological Science*, 20(5):603–611.

Krifka, M. (1992). Thematic relations as links between nominal reference and temporal constitution. In Sag, I. A. and Szabolcsi, A., editors, *Lexical matters*, pages 29–53. CSLI Publications, Stanford, CA.

Malaia, E. (2014). It still isn't over: Event boundaries in language and perception. *Language and Linguistics Compass*, 8(3):89–98.

Strickland, B., Geraci, C., Chemla, E., Schlenker, P., Kelepir, M., and Pfau, R. (2015). Event representations constrain the structure of language: Sign language as a window into universally accessible linguistic biases. *Proceedings of the National Academy of Sciences*, 112(19):5968–5973.

References II

Wilbur, R. (2003). Representations of telicity in ASL. In *Chicago Linguistic Society 39*, pages 354–368.

Zacks, J., Speer, N., Swallow, K., Braver, T., and Reynolds, J. (2007). Event perception: A mind-brain perspective. *Psychological Bulletin*, 133(2):273–293.

Zeshan, U. (2004). Hand, head, and face: Negative constructions in sign languages. *Linguistic Typology*, 8:1–58.

Spoken language

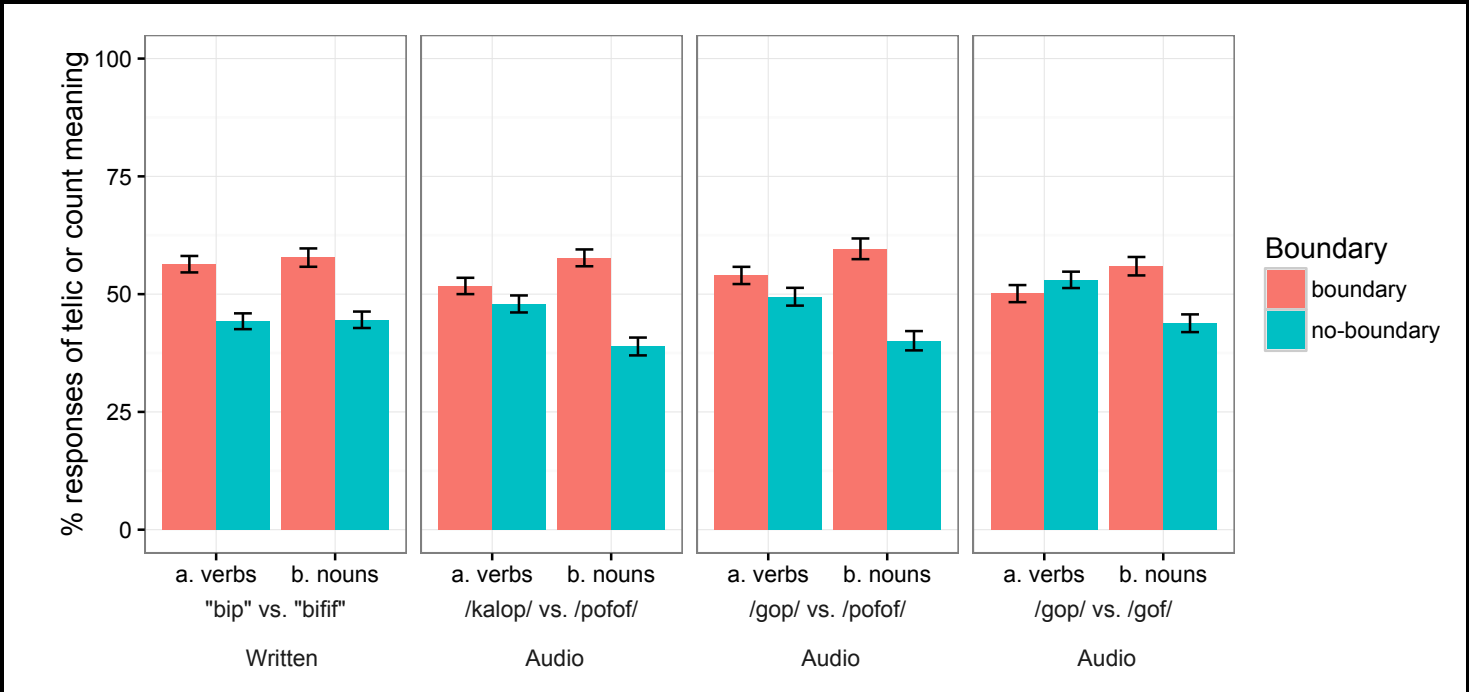
What might it mean to have a boundary in sound?

Spoken language

What might it mean to have a boundary in sound?

- Phonological **stops**: airflow and sound stop
  - p, b, t, d, k, g
- **Continuants**: airflow and sound continue
  - f, v, s, z, sh, zh

Exp. 4: Results



- Written stimuli replicate bias seen in sign stimuli.
- Audio stimuli show an effect for *nouns* only (in each of three variations of the stimuli...)

Linguistic blocking

Why a different pattern for audio stimuli?

Interference from language-specific knowledge:

1. Categorical perception *blocks* iconic inferences
2. Non-iconic sources of systematicity for nouns?
    - Phonotactics: *fits* better than *fifths*

English: meaning

Bochum English Countability Lexicon

(11,869 word senses)

22935,1	cactus	any succulent plant of the family Cactaceae	235	regular_count
25973,1	cadaver	the dead body of a human being; "the cada	235	regular_count
21412,1	cadet	a military trainee (as at a military academy)	235	regular_count
422,1	cadmium	a soft bluish-white ductile malleable toxic b	519	regular_mass
39897,1	cafe	a small restaurant where drinks and snacks	235	regular_count
25457,1	cafeteria	a restaurant where you serve yourself and	235	regular_count
31392,1	caffeine	a bitter alkaloid found in coffee and tea tha	528	regular_mass
33305,3	cake	baked goods made from or based on a mixt	726	both_mass_count
33305,1	cake	a block of solid substance (such as soap or	235	regular_count
4160,1	calcium	a white metallic element that burns with a	528	regular_mass
26976,3	calculation	planning something carefully and intention	528	regular_mass
38790,1	calendar	a system of timekeeping that defines the b	235	regular_count
38790,2	calendar	a list or register of events (appointments o	235	regular_count

English: phonology

CMU pronouncing dictionary (American English)
(116,193 word pronounciations)

```
EXPERIMENT IH0 K S P EH1 R AH0 M AH0 N T
EXPERIMENT'S IH0 K S P EH1 R AH0 M AH0 N T S
EXPERIMENTAL IH0 K S P EH2 R AH0 M EH1 N T AH0 L
EXPERIMENTAL(2) IH0 K S P EH2 R IH0 M EH1 N T AH0 L
...
PHILOSOPHICAL F IH2 L AH0 S AA1 F IH0 K AH0 L
PHILOSOPHICALLY F IH2 L AH0 S AA1 F IH0 K AH0 L IY0
PHILOSOPHIES F AH0 L AA1 S AH0 F IY0 Z
PHILOSOPHY F AH0 L AA1 S AH0 F IY0
```

English: Results

- Monomorphemic words (2,048 count; 250 mass)
- Word-final phoneme
- $\chi^2(4) = 59.9, p < 0.001$